DRAFT Future Tactical Truck Systems Maneuver Sustainment Vehicle (FTTS MSV) Performance Specification

November 25, 2003

1.0 SCOPE

1.1 Scope. This performance specification identifies the physical capabilities and inspection requirements for the FTTS MSV.

a. Physical characteristics and performance requirements for the vehicles.

b. Identification of the performance and quality test requirements used to verify the vehicles meet the specific performance.

1.2 General Description. The FTTS MSV is a motor transport vehicle system that primarily fulfills non-Future Combat Systems (FCS) manned ground vehicle roles of sustainment, support, and distribution in the Future Combat Systems (FCS) equipped Unit of Action (UA). The Army Unit of Action (UA) deploys throughout the world and must be prepared to conduct operations across the operational continuum. The mission of the FTTS MSV is to provide tactical/strategic transportation and support within all elements of the Unit of Action (UA). To successfully accomplish its mission, the UA requires a ground logistics system that is highly mobile, efficient, extremely reliable, and flexible. The FTTS MSV will be capable of keeping pace with the increasingly mobile and widely dispersed maneuver forces dictated by Objective Force Operational and Organizational Plan. The FTTS must be capable of operating over increased distances. The FTTS will distribute all classes of supplies without need of external Materiel Handling Equipment (MHE). The FTTS MSV will replace current heavy tactical wheeled vehicles in the objective UA. *(Ref. FTTS MSV CDD 1.5.1)*

1.3 Vehicle Variants. The FTTS MSV shall be capable of transport of equipment, NATO flatracks, varied mission module (e.g., bulk fuel and water, ammunition, and cargo transport), and receiving and transporting standardized containers (Twenty-foot Equivalent Units (TEU)). The FTTS MSV will be employed throughout the UA. The FTTS MSV will have the capability to collect, receive, and transmit asset tracking information and diagnostic/prognostic information utilizing known and emerging supply and maintenance management systems at the time of procurement. *(Ref. FTTS MSV CDD 1.5.2)*

2.0 APPLICABLE DOCUMENTS

2.1 Government documents. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issue of these documents are those listed in the issue of the Department of Defense Index of Specifications and Standards (DODISS) and in effect on the date of Request for Proposal.

MILITARY SPECIFICATIONS

DEPARTMENT OF DEFENSE:

A-A-50271	Plate, Identification
A-A-52418	Light, Warning, Vehicular: Rotating, Unit, 14 and 28 Volt DC
A-A-52432	Mirror Assembly, Rearview: Automotive Exterior Mounting
A-A-52474	Electrocoating Primer
A-A-52507	Chain Assembly and Cross Chain, Tire: For Military Vehicles
A-A-52513	Bracket Assembly, Liquid Container, Five Gallon
A-A-52525	Horns and Buzzers, Air- and Electrically-Actuated
A-A-52557	Fuel Oil, Diesel; For Posts, Camps and Stations
A-A-52624	Antifreeze, Multi-Engine Type
A-A-59326	Coupling Halves, Quick-Disconnect, Cam-Locking Type
A-A-59487	Padlock (Key Operated)
MIL-PRF-2104	Lubricating Oil, Internal Combustion Engine,
	Combat/Tactical Service
MIL-PRF-2105	Lubricating Oil, Gear, Multipurpose
	(Metric)
MIL-PRF-10924	Grease, Automotive And Artillery
MIL-PRF-20696	Cloth, Waterproof, Weather Resistant
MIL-S-40626	Sign Kit, Vehicle Class
MIL-PRF-46167	Lubricating Oil, Internal Combustion
	Engine, Arctic
MIL-PRF-52308	Filter-Coalescer Element, Fluid Pressure
MIL-C-53072	Chemical Agent Resistant Coating (CARC)
	System Application Procedures and Quality
	Control Inspection
MIL-P-53084	Primer, Cathodic Electrodeposition, Chemical
	Agent Resistant
MIL-PRF-62048	Air Cleaners, Automotive: Heavy
	Duty, Dry-Type (For Internal Combustion
	Engines) (Metric)

MIL-DTL-83133	Turbine Fuels, Aviation, Kerosene Types,
	NATO F-34 (JP-8), NATO F-35, and
	JP-8+100
MIL-V-81940	Valve, Sampling and Bleed, Hydraulic,
	Type II Systems

STANDARDS

FEDERAL

FED-STD-595	Colors Used in Government Procurement

DEPARTMENT OF DEFENSE

MIL-STD-129	Standard Practice For Military Marking
MIL-STD-209	Lifting and Tie-down Provisions
MIL-STD-209	E Lifting and Tie-down Provisions
MIL-STD-209	G Lifting and Tiedown Provisions
MIL-STD-461	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD-461 B	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD-461C	Requirements for the Control of Electromagnetic Interference Characteristics of Subsystems and Equipment
MIL-STD-462 Interim Notice 4	Measurement of Electromagnetic Interference Characteristics
MIL-STD-462 Interim Notice 5	Measurement of Electromagnetic Interference Characteristics
MIL-STD-704E	Aircraft Electric Power Characteristics
MIL-STD-810	Environmental Engineering Considerations and Laboratory Tests
MIL-STD-889	Dissimilar Metals
MIL-STD-1275	Characteristics of 28 Volt DC Electrical Systems in Military Vehicles
MIL-STD-1366	Transportability Criteria
MIL-STD-1472	Human Engineering
MIL-STD-1474	Noise Limits

HANDBOOKS

DEPARTMENT OF DEFENSE

MIL-HDBK-454	General Guidelines for Electronic Equipment
MIL-HDBK-1791	Designing for Internal Aerial Delivery in Fixed Wing Aircraft

(Unless otherwise indicated, copies of the above specifications, standards, and handbooks are available from the Standardization Document Order Desk, 700 Robbins Avenue, Building 4D, Philadelphia PA 19111-5094.)

2.2. Other Government documents, drawings, and publications. The following other Government documents, drawings, and publications form a part of this document to the extent specified herein. Unless otherwise specified, the issues are those cited in the solicitation.

Training and Doctrine Command Pamphlet 525-3-90/O&O(Change 2), The United States Army Objective Force Operational and Organizational Plan Maneuver Unit of Action, 30 June 2003.

TRADOC Pamphlet 525-4-0, US Army Concept for Maneuver Sustainment Operations in Support of the Objective Force (Draft), 23 Jan 03 U.S. Army White Paper: Concepts for the Objective Force

(Application for copies should be addressed to the U.S. Army Tank automotive and Armament Command, ATTN: AMSTA-LC-AH, Warren, MI 48397-5000)

C-130 Transportability of Army Vehicles, Military Traffic Management Command Transportation Engineering Agency, 11 Sept. 02, Joseph Cassidy.

US ARMY EDGEWOOD RESEARCH DEVELOPMENT AND ENGINEERING CENTER

D5-15-8779 Interface for M-8 Alarm

Application for copies should be addressed to the: Technical Director, US Army Edgewood Research Development and Engineering Center, ATTN: SCBRD-RT/ASM, Aberdeen Proving Ground, MD 21010-5423)

US ARMY COMMUNICATIONS ELECTRONICS MATERIEL READINESS COMMAND

A3013814	SINCGARS AN/VRC-90 Radio Set
A3013842	Antenna (AS-3684)

A3014039	Power Cable
A3019214	Mounting Base, Electrical Equipment For The MT6352/VRC-VEC
SCD189023	Antenna Support Assembly

(Application for copies should be addressed to the: US Army Communications and Electronics Materiel Readiness Command, Logistics Engineering Directorate, 12WD Bldg. 601 McAfee Center, Fort Monmouth, NJ 07703)

TECHNICAL BULLETIN (TB)

U. S. ARMY TANK-AUTOMOTIVE AND ARMAMENT COMMAND

TB 43-0213	Corrosion, Prevention and Control Including Rust proofing Procedures for Tactical Vehicles and Trailers

(Application for copies should be addressed to the U.S. Army Tank automotive and
Armament Command, ATTN: AMSTA-LC-AH, Warren, MI 48397-5000)

REGULATIONS, ARMY

AR 70-38	Research, Development, Test and Evaluation of Materiel for Extreme Climatic Conditions

(Copies are available from the following website:
http://www.usace.army.mil/inet/usace-docs/army-reg)

GOVERNMENT AGENCIES

CALIFORNIA AIR RESOURCES BOARD (CARB)

Tank Pressure and Vacuum Requirements

(Application for copies should be addressed to the: California Air Resources Board, 2020 L Street, Sacramento, CA 95814)

DEPARTMENT OF TRANSPORTATION (DOT)

Federal Motor Vehicle Safety Standards (FMVSS)

178.346	Cargo Tank Motor Vehicle (DOT 406)
571.101	Controls and Displays
571.102	Transmission Shift Lever Sequence, Starter

	Interlock, and Transmission Braking Effect
571.104	Windshield Wiping and Washing Systems
571.108	Lamps, Reflective Devices, and Associated Equipment
571.119	New Pneumatic Tires for Vehicles other Than Passenger Cars
571.120	Tire Selection and Rims for Motor Vehicles Other Than Passenger Cars
571.121	Air Brake Systems
571.124	Accelerator Control Systems
571.208	Occupant Crash Protection
571.209	Seat Belt Assemblies
571.210	Seat Belt Assemblies Anchorage

Federal Motor Carrier Safety Regulations (FMCSR)

393.27	Wiring Specifications
393.28	Wiring to Be Protected
393.29	Grounds
393.30	Battery Installation
393.31	Overload Protection Devices
393.32	Detachable Electrical Connections
393.33	Installation Wiring,
393.40	Required Brake Systems
393.41	Parking Brake System
393.42	Brakes Required on All Wheels
393.43	Breakaway and Emergency Braking
393.45	Brake Tubing and Hose, Adequacy
393.46	Brake Tubing and Hose Connections
393.47	Brake Lining
393.48	Brakes to Be Operative
393.49	Single Valve to Operate All Brakes
393.50	Reservoirs Required
393.51	Warning Devices and Gauges
393.52	Brake Performance
393.55	Antilock Brake Systems
393.65	All Fuel Systems
393.67	Liquid Fuel Tanks
393.70	Coupling Devices and Towing Methods, Except for Driveaway-Towaway Operations Exhaust Systems
393.83	Exhaust Systems
393.95	Emergency Equipment on All Power Units

(Application for copies should be addressed to the Dept of Transportation, Federal Highway Administrations, Washington, DC 20591)

ENVIRONMENTAL PROTECTION AGENCY (EPA)

Control of Air Pollution from New Motor Vehicles and New Motor Vehicle Engines

Compliance with Interstate Motor Carrier Noise Emission Standards

(Application for copies should reference "Code of Federal Regulations 40 CAR and the Federal Register, and should be addressed to the Superintendent of Documents, US Government Printing Office, Washington, DC 20402)

NATIONAL FIRE PROTECTION AGENCY (NFPA)

NFPA 407	Standard for Aircraft Fuel Servicing (National Fire Codes, Vol. 7)
NFPA 70	National Electrical Code

(Application for copies should be addressed to the National Fire Protection Agency, One Batterymarch Park, PO Box 9101, Quincy, MA 02269-9101)

NORTH ATLANTIC TREATY ORGANIZATION (NATO) STANDARDIZATION AGREEMENT (STANAG)

STANAG 2413	Demountable Load Carrying Platforms (DLCP/Flatracks)
STANAG 4007	Electrical Connectors Between Prime Movers, Trailers and Towed Artillery
STANAG 4074	Auxiliary Power Unit Connections for Starting Tactical Land Vehicles
QSTAG 244 Ed 3	Nuclear Survivability Requirements For Military Equipment

NORTH ATLANTIC TREATY ORGANIZATION (NATO) ALLIED VEHICLE TESTING PUBLICATION (AVTP)

AVTP 03-30WT	Steering and Maneuverability
AVTP 03-160 W	Dynamic Stability

(Applicable NATO documents are those that are current at NATO Headquarters (Military Agency for Standardization , 1110 Brussels). Copies are available from Global Engineering, Inc., 15 Inverness Way East, Englewood, CO 80112).

OCCUPATIONAL SAFETY & HEALTH ADMINISTRATION (OSHA)

Title 29, CFR, Part 1910.1000	Air Contaminants
Crane Safety Standards	

(Application for copies should be addressed to the American Conference of Government Industrial Hygienists (ACGIH), 1330 Kemper Meadow Drive, Cincinnati, OH 45240).

2.3 Non-Government Publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of the documents which are DoD adopted are those listed in the issue of the DoDISS cited in the solicitation. Unless otherwise specified, the issues of documents not listed in the DoDISS are the issues of the documents cited in the solicitation (see 6.2).

AMERICAN PETROLEUM INSTITUTE (API)

API STD 1529	Aviation Fueling Hose (DOD Adopted)
API SPEC 1581	Specifications and Qualification Procedures for Aviation Jet Fuel Filter/Separators

(Application for copies should be made to the: American Petroleum Institute, 1220 L St NW, Washington, DC 200005)

AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME)

ASME B30.5 Mobile and Locomotive Cranes

(Applications for copies should be addressed to the: American Society of Mechanical Engineers, 345 East 47th Street, New York, NY 10017)

AMERICAN SOCIETY FOR TESTING & MATERIALS (ASTM).

D522 Mandrel Bend Test of Attached Organic Coatings (DOD Adopted)

D1171 Rubber Deterioration – Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens) (DOD Adopted)

(Applications for copies should be addressed to the: American Society for Testing & Materials 100 Bar Harbor Drive, West Conshohocken, PA 19428-2959)

GENERAL MOTORS (GM)

GM 9540P Accelerated Corrosion Test

(Application for copies should be addressed to Global Engineering, 7730 Carondelet Ave., Suite 407, St. Louis, MO 63105)

INTERNATIONAL ORGANIZATION OF STANDARDIZATION (ISO)

668 Series 1 Freight Containers – Classification, Dimensions and Ratings

(Application for copies should be addressed to International Organization of Standardization (ISO), Case Postale 56, Geneva, Switzerland CH-1211)

SOCIETY OF AUTOMOTIVE ENGINEERS, INC. (SAE)

AS8090 Mobility, Towed Aerospace Ground Equipment, General Requirements for (DOD Adopted)

J163 Low Tension Wiring and Cable Terminals and Splice Clips (DOD Adopted)

J198 Windshield Wiper Systems - Trucks, Buses, and Multipurpose Vehicles (DOD Adopted)

J318 Automotive Air Brake Line Couplers (Gladhands)

J336 Sound Level for Truck Cab Interior (DOD Adopted)

J343 Test and Test Procedures for SAE 100R Series Hydraulic Hose and Hose Assemblies

J366 Exterior Sound Level for Heavy Trucks and Buses (DOD Adopted)

J381 Windshield Defrosting Systems Test Procedures - Trucks, Buses, and Multipurpose Vehicles (DOD Adopted)

J382 Windshield Defrosting Systems Performance Requirements Trucks, Buses, and Multipurpose Vehicles (DOD Adopted)

J516 Hydraulic Hose Fittings

J517 Hydraulic Hose

J534 Lubrication Fittings (DOD Adopted)

J560 Seven Conductor Electrical Connector for Truck-Trailer Jumper Cable (DOD Adopted)

J682 Rear Wheel Splash and Stone Throw Protection (DOD Adopted)

J683 Tire Chain Clearance-Trucks, Buses (Except Suburban, Intercity, and Transit Buses), and Combinations of Vehicle (DOD Adopted)

J697 Safety Chain of Full Trailers or Converter Dollies

(DOD Adopted)
J701 Truck Tractor Semitrailer Interchange Coupling Dimensions (DOD Adopted)
J706 Rating of Winches (DOD Adopted)
J994 Alarm - Backup - Electric Laboratory Performance Testing, Standard (DOD Adopted)
J1100 Motor Vehicle Dimensions (DOD Adopted)
J1292 Automobile, Truck, Truck-Tractor, Trailers, and Motor Coach Wiring (DOD Adopted)
J1436 (R) Requirements for Engine Cooling System Filling, Deaeration, and Drawdown Tests, Information Report
J1587 Joint SAE/TMC Electronic Data Interchange between Microcomputer Systems in Heavy Duty Vehicle Applications
J1708 Serial Data Communications between Microcomputer Systems in Heavy-Duty Vehicle Applications 13
J1850 Class B Data Communications Network Interface
J1939 Series: J1939-11 Physical Layer – 250K bits/s, Shielded Twisted Pair

J1939-13 Off-Board Diagnostic Connector
J1939-21 Data Link Layer
J1939-31 Network Layer
J1939-71 Vehicle Application Layer
J1939-73 Application Layer – Diagnostics
J1939-81 Recommended Practice for Serial Control and Communications Vehicle Network – Part 81 – Network Management
J1992 Wheels/Rims – Military Vehicles – Test Procedures and Performance Requirements
J2014 Pneumatic Tires for Military Tactical Wheeled Vehicles

(Applications for copies should be addressed to the: Society of Automotive Engineers, Inc., 400 Commonwealth Drive, Warrendale, PA 15096)

TIRE AND RIM ASSOCIATION (TRA) INCORPORATED

TRA 1-Year Book

(Application for copies should be addressed to the: TRA Inc., 175 Montrose West Avenue, Suite 150, Copley, OH 44321)

2.4. Order of precedence. In the event of a conflict between the text of this specification and the references cited herein, the text of this specification should take precedence.

1. Contract Document
2. FTTS MSV Performance Specification, dated 24 November 2003
3. Government Standards, specifications or handbooks.
4. Non-government standards, specifications or handbooks.

2.4.1 Compliance with Laws & Regulations. The requirements and specifications contained in the above documents shall not be interpreted as a waiver or allowance to supersede any law or regulation unless a specific exemption has been obtained.

3.0 VEHICLE REQUIREMENTS.

3.1 Mission Profile.

FTTS MSV Tactical Mobility" is defined as 30 percent improved roads (paved and gravel) and 70 percent-unimproved roads (trails) and cross-country. Cross-country includes beaches, forests, grasslands, tropical jungles, mountains, and deserts throughout all seasonal conditions.

Road Surface	Terrain	% Operation		*RMS
		(Threshold)	(Objective)	
Improved	Hard Surfaced	53.2	10	0.1" – 0.3"
	Gravel	7.7	20	0.3" – 1.0"
Unimproved	Trails & Cross-country	39.1	70	1.0" – 4.8"

* Root Mean Squared (RMS) is a measure of surface and terrain roughness used to evaluate trafficability

3.1.1 Weight Definitions.

3.1.1.1 Curb Weight (CW). Curb weight of the vehicle shall be defined as the Empty vehicle weight, full compliment of fuels, fluids, lubricants, coolant, integral survivability and BII.

3.1.1.2 Gross Vehicle Weight (GVW). CW plus the weight of 2 soldiers (4 soldiers desired) and their individual equipment and weapons, trailer tongue weight (10 percent of the towed load GVW), supplemental armor, and payload (payload includes mission essential support equipment, unique digital appliqué, and non-mission essential kits, such as cargo compartment heater kit and cargo compartment protection kit). The planning factor per soldier with individual equipment is 356 pounds (weight estimates per FCS developmental weights). *(Ref. FTTS MSV CDD 4.0.3.2)*

3.1.1.3 Gross Combined Weight (GCW). Gross combined weight shall be defined as the gross vehicle weight plus the weight of the towed load. All characteristics requiring evaluation at GCW shall be performed using the FTTS MSV companion trailer (CT) at its maximum payload as

well as towed loads required for specific mission applications. *(Ref. FTTS MSV CDD 4.0.33)*

3.1.2 Payload. The FTTS MSV shall be capable of transporting a payload of 11 ST plus 2 ST flatrack (Threshold) or 12 ST plus 1 ST flatrack (objective).

3.1.3 Dimensions. Dimensions shall be as follows, when the vehicle is at GVW, unless otherwise specified.

3.1.3.1 Width. The vehicle shall not exceed 96 inches in width when measured IAW SAE J1100 excluding grab handles and tire bulges.

3.1.3.2 Height. MSV must be capable of negotiating a 4-meter underpass while transporting an empty ISO 668, Type 1C freight container mounted on a flatrack without preparation. Overall height of FTTS MSV must not exceed 142 inches. While being transported on a C-130 aircraft, height must not exceed 102 in (threshold).

3.1.3.3 Length. The overall length of the Mission System (uploaded prime mover coupled with uploaded Trailer) shall not exceed 60 ft (verify requirement with MTMC-TEA) during highway and secondary road operation (without extended drawbar kit). Mission System may exceed 60 ft as required to preclude interference between the truck and trailer such as during cross-country operation. The Swing Radius (SR) and Clearance (CT) minimum dimensions shall comply with SAE J701.

3.1.4 Environment.

3.1.4.1 Operating Temperatures. The FTTS MSV shall be able to start and operate in temperatures from -25° to 125° F without special kits, maintaining full mission capability (threshold) and –25° F to –50° F with special kits while maintaining 90 per cent mission capability (objective). The vehicle must start and attain operating temperatures in extreme cold in no more than 30 minutes. *(Ref. FTTS MSV CDD 4.1.2.5.12.2)*

3.1.4.2 Storage Temperatures. The FTTS MSV and its companion trailer must be capable of being placed in storage at temperatures ranging between –60° F and 160° F without degradation. *(Ref. FTTS MSV CDD 4.1.2.5.12.3)*

3.1.4.3. Heater & Defroster. The vehicle shall come equipped with a heater, blower and defroster. The heater shall be capable of raising the cab temperature from -25 to +41 degrees F (-32 to +5 degrees C) within 45 minutes (threshold) 20 minutes (objective) after the vehicle has been started. The blower shall be operable independent of the heater. Windshield defrosting and defogging system shall conform to SAE J382, Area "A" at ambient temperatures of down to -50 degrees F (-46 degrees C) within 1 hour when and tested in accordance with SAE J381.

3.1.4.4 Cab Cooling. The FTTS MSV shall have internal environmental control measures to ensure personnel can work in the vehicle for extended periods of time. Cab-cooling requirements shall be met with windows closed. (A kit may be used to meet this requirement. If a kit

is used, it shall be installed at field level *(Ref. FTTS MSV CDD 4.1.2.1.2.2)*

3.2 PERFORMANCE CHARACTERSITICS.
All performance requirements shall be met with the vehicle at Gross Vehicle Weight (GVW) with uniformly distributed payload whose CG is 24 inches above the cargo bed, unless otherwise specified. If Gross Combination Weight (GCW) is specified, the CT (Companion Trailer with uniformly distributed payload whose CG is 24 inches above the cargo bed) shall be the trailer for all Mission Vehicles, unless otherwise specified. Minimum payload requirements are 11 ST plus flatrack (see paragraph 3.1.2.). All performance requirements shall be met while operating on JP-8(MIL-DTL-83133) (threshold). The system shall be capable of all slope operations as specified herein with 10% of the fuel tanks useable volume remaining and without leakage when at maximum rated capacity. Grade surface shall be smooth, dry, hard surface pavement. Annexes A, B, C, D and E contain MSV mission specific variant requirements. Classified Annex G contains the MSV survivability requirements.

3.2.1 Mobility. The mobility characteristics shall equal or exceed those quantified in the following paragraphs:

3.2.1.1 Dash Speed. The FTTS MSV at GVW must be capable of a dash speed which is characterized by the ability to accelerate from 0 to 48 kph (30 mph) on level hard terrain within 12 seconds (threshold)/10 seconds (objective). The FTTS MSV will be able to repeat this acceleration at least ten times in succession. *Ref. FTTS MSV CDD 4.1.2.4.7)*

3.2.1.2 Governed Speed. Maximum geared speed at engine full load governed speed shall not exceed 65 mph for all vehicles. Engine governed speed shall not exceed the maximum RPM rating specified by the engine manufacturer.

3.2.1.3 Lateral Stability. For the FTTS MSV the roll stability as determined from a steady-state circular turn test on a 170 to 200 foot radius course with a level, paved surface shall meet or exceed a wheel-liftoff threshold of 0.5 g's.

3.2.1.4 Approach & Departure Angles. Protrusion of the tow eyes into the angle of approach plane is permitted. The angle of approach shall not be less than 41 degrees and the angle of departure not less then 39 degrees in the area of the pintle hook. Angles shall be defined in accordance with SAE J1100.

3.2.1.5 Braking. Unless otherwise specified in this performance spec, the performance of the brake system shall comply with FMVSS 571.121. The brake system of all vehicles post-production shall be burnished sufficient for the MSV to meet the grade holding requirements of this performance specification.

3.2.1.5.1 Service Brakes. Service brakes shall meet the requirements of FMVSS 571.121, without regard for the exceptions of paragraph S3. Service brakes shall bring the vehicle to a complete stop from a speed of 20 mph (32 km/hr) within 30 feet (9 M), measured from the point of

brake application (to a tolerance of two (2) feet shall be acceptable). The service brakes shall hold the vehicle at GVW on a dry hard surface, 60% Grade(30.96 degree slope) pointing either uphill or downhill.

3.2.1.5.2 Parking Brakes. The vehicle parking brake shall be capable of holding the chassis motionless in either direction on a 30% grade(16.70 degree slope) with maximum payload, with the engine off and the transmission in neutral. An indicator light shall be provided to alert the crew when the parking brake is engaged.

3.2.1.5.3 Emergency brakes. The emergency brake system, in the event of a single point failure in the service brake system, shall stop the truck at GVW on a 30% grade (16.70 degree slope). The vehicle at GVW, on dry level primary roads, shall be capable of stopping within 170 feet (52 M) (measured at point of brake application) while traveling at least 30 mph (48 km/hr) and within 530 feet (162 M) while traveling at least 55 mph (90 km/hr). Emergency brakes shall activate after both the visual and audible low air pressure warnings have activated. Emergency braking shall include a means of stopping the vehicle in the event that any loss of air pressure occurs as a result of trailer breakaway. Emergency braking requirements shall be met without the use of the retarder.

3.2.1.5.4 Brake Configuration. Brakes shall conform to Federal Motor Vehicles Safety Standards (FMVSS) 571.121 and Federal Motor Carriers Safety Regulations (FMCSR) 393.40 through 393.42 (b), 393.43, and 393.45 through 393.52, and 393.55. All brakes shall be releasable from the cab in the tactical environment in the event of emergency lock-up per FMVSS 393.41.c. Brake system shall be designed to minimize exposure to "off-road hazards" and maximize ground clearance.

3.2.1.5.5 Antilock Braking System (ABS). A multi-channel Antilock Braking System shall be installed on all variants that meet the requirements for brake performance specified within FMVSS 571.121 regulation. Deactivating the ABS shall not deactivate traction control system. The system shall have built in test for troubleshooting and crew indication. The diagnostic information shall display system error either on board or through the SAE J1587/J1939 data bus.

3.2.1.5.6 Brake Wear Indicator. The FTTS MSV shall be equipped with a warning system to quickly determine the brake pad’s remaining life.

3.2.1.6 Terrain. TARDEC Mobility The vehicle shall be capable of operating over terrain, as shown in

Table I FTTS MSV at GVW

	Terrain	Germany		Mideast	
		Dry	Wet	Dry	Sand
V80 speeds, mph (average speed over 80% of the terrain)	Standard tactical	18.1	15.0	17.9	11.2
Maximum no-go, %		7.5	19.9	9.8	14.1

Table II FTTS MSV with Companion Trailer at GCW

	Terrain	Germany		Mideast	
		Dry	Wet	Dry	Sand
V80 speeds, mph (average speed over 80% of the terrain)	Standard tactical	17.1	9.6	17.6	11.7
Maximum no-go, %		6.6	23.7	0.9	18.9

Table I & II. The mobility characteristics will be quantified using NATO Reference Mobility Model (NRMM), version 2.5.9a, at full combat configuration. The values in Table I and II, including tractive effort and Vehicle Cone Index (VCI), will be used for evaluation purposes only (the supplier shall identify the performance).

The vehicle single pass vehicle cone index (VCI [VCI1]) for mud/sand/snow shall have a value no greater than 25.0, with the tire pressure set at an appropriate reduced level, and using a corresponding increased section width.

3.2.1.7. Ride Quality. The FTTS MSV shall meet the ride quality requirements at curb weight and GVW.

3.2.1.7.1 Ride Limiting Speeds. The FTTS MSV shall attain no more than 6 watts average vertical absorbed power, as measured at all occupant seats as well as the entire cargo compartment of the FTTS MSV and its companion trailer, while negotiating the following Root Mean Square (RMS) ride courses at speeds listed below, with the tires at normal tire pressure (cross-country tire pressure, if equipped with a Central Tire Inflation System [CTIS]). *(Ref. FTTS MSV CDD 4.1.2.4.1)*

6-Watt Speeds (MPH)

US imperial units (RMS)	SI units (RMS)	Digitized NRMM course
55 mph at 1.38 in	88.5 kph at 3.5 cm	FTKN 12 A
45 mph at 1.50 in	72.4 kph at 3.8 cm	
35 mph at 1.73 in	56.3 kph at 4.4 cm	LET5*RT
25 mph at 2.00 in	40.2 kph at 5.2 cm	YPG#4
20 mph at 2.25 in	32.2 kph at 5.7 cm	APG course 29
15 mph at 2.50 in	24.1 kph at 6.3 cm	LET#7 RT
10 mph at 2.72 in	16.1 kph at 6.9 cm	
5 mph at 3.00 in	8.0 kph at 7.6 cm	

3.2.1.7.2 Vertical Acceleration. The FTTS MSV shall sustain no more than 2.5-G peak vertical acceleration, as measured at the occupants' location as well as the entire cargo compartment of the FTTS MSV and its companion trailer, while negotiating a non-deformable, half-round obstacle at the rated speed as listed below with the tires at normal tire pressure (cross-country tire pressure, if equipped with a CTIS).

Obstacle Crossing Speeds (MPH)

Version	Obstacle Height (inches)		
	6	8	10
Speed at GVW (mph)	50	40	25

3.2.1.8. Reserved.

3.2.1.9. Reserved.

3.2.1.10 Grade & Slope Operations.

3.2.1.10.1 60% Grade(30.96 degree slope). The FTTS MSV at GVW (Threshold) shall be capable of ascending/descending, starting, and stopping on dry, hard-surfaced longitudinal slopes up to and including 60% grade (30.96 degree slope). At GCW, the FTTS MSV shall be capable of ascending/descending, starting, and stopping on dry, hard-surfaced longitudinal slopes up to and including 60% grade. The vehicle engine shall be capable of being turned off and restarted while on the 60% grade. The engine off times shall be of such long duration as to assure that there shall be no loss of fluids or other malfunction while parked on the slope. *(Ref. FTTS MSV CDD 4.1.2.4.12.1)*

3.2.1.10.2 Parking Brake Grade Operation. At GCW, the FTTS MSV shall be capable of holding in either direction on a 30-percent longitudinal Grade(16.70 degree slope) (Threshold) (40-percent(21.8 degree slope) - Objective) using only the FTTS MSV parking brake with the engine off and the transmission in neutral. Grade surface shall be dry, hard and free from loose material. (*Ref. FTTS MSV CDD 4.1.2.4.12.2*)

3.2.1.10.3 40% Side Slopes. The FTTS MSV at GVW, shall be capable of traversing side slopes up to and including 40 percent. Side slope operation shall be performed with either side of the vehicle facing up slope and without loss of stability or malfunction/degradation of stated requirements or loss of vehicle fluids. *(Ref. FTTS MSV CDD 4.1.2.4.12.3)*

3.2.1.10.4 5% Grade. The FTTS MSV and its companion trailer both at GVW shall be capable of continuously ascending a 5-percent grade at 55 MPH (Threshold) (60 MPH – Objective): *(Ref. FTTS MSV CDD 4.1.2.4.13)*

3.2.1.11 Tires.

3.2.1.11.1 Rims & Tires. Rims and tires shall meet the requirements of SAE J1992 and conform to FMVSS 571.119 and 571.120. Vehicle and trailer tires (threshold) shall be a tubeless radial design with bolt-together rims and beadlock. All tire and rim ratings shall conform to the Tire and Rim Association (TRA) 1 or the European Tire and Rim Technical Organization (ETRTO) Standards Manual for the

maximum GCW and maximum speed of the vehicle. The vehicle shall have tires with tread design that maximizes off-road mobility but maintains safe on-road handling. All wheel assemblies shall be interchangeable across all vehicle/trailer types. Tires shall have a minimum life of 18,000-miles over FTTS OMS/MP terrain, without retreading.

3.2.1.11.2 Run-Flat Capability. The run-flat capability shall permit safe driving after loss of air pressure in any two tires (Threshold) (all tires - Objective) for at least 30 miles (Threshold) (60 miles - Objective) without speed reduction over the OMS/MP terrain. *(Ref. FTTS MSV CDD 4.1.2.7.10)*

3.2.1.11.3 Limp Home Capability. The loss of the function of one wheel (threshold), (two wheels-Objective) shall not impede the FTTS MSV from driving 30 miles (threshold)(60 miles – Objective) without speed reduction over the OMS/MP terrain. This capability shall be for emergency operation only in case of wheel bearing failure, damaged wheel, inability to change wheel/tire, etc.

3.2.1.11.4 Central tire Inflation System (CTIS). The FTTS MSV and its companion trailer shall incorporate means to adjust tire pressure to increase cross-country mobility. The FTTS MSV shall incorporate this capability to allow the operator to adjust tire pressure:

- To/From GVW to GCW
- by axle
- For terrain conditions

The FTTS MSV and its companion trailer shall have the capability to inflate/deflate. (*Ref. FTTS MSV CDD 4.1.2.5.14, 4.1.2.5.15)*

3.2.1.11.4.1 Tire Pressure Control. The system shall allow the driver to adjust all truck and companion trailer tires to any one of four preset tire pressures (highway, cross country, mud/snow/sand, emergency). The system control shall be located so that the system may be activated while the driver continues to operate the FTTS MSV.

3.2.1.11.4.2 Manual Tire Inflation/Deflation. The system shall provide for the isolation of any or all tires from the CTIS in the event of CTIS failure for any reason. Valves for manual inflation shall be readily accessible and compatible with the standard on-board inflation system.

3.2.1.11.4.3 Air-Priority System. The CTIS shall incorporate sufficient safeguards to assure that air pressure necessary to continue safe operation of the FTTS MSV System shall be available at all times during activation of CTIS or in the event of a CTIS failure. Use of brakes is the minimum requirement for safe operation.

3.2.1.11.4.4 Speed/Pressure Control Warning. The CTIS shall include sensing of the vehicle speed and comparing indicated speed to the maximum allowable speed for each control setting. In the event that the vehicle average speed exceeds maximum allowable speed for that

setting for a period of more than one minute, an indicator shall activate to warn the driver of this condition until the system has automatically inflated to the appropriate pressure.

3.2.1.11.4.5 Maintenance of Tire Pressure. With the CTIS in operation, tire pressure shall be checked and adjusted at intervals necessary to assure that no more than 3 psi variation exists between selected pressure and actual pressure except during the inflation/deflation operation caused by the selection of a new tire pressure. With the CTIS not in operation and the vehicle engine not running after 24 hours, the tire pressure shall not drop below 97% of the pressure setting which existed before the vehicle was stopped. No action shall be required of crew personnel beyond normal shutdown to meet this requirement.

3.2.1.11.4.6 Time to Inflation/Deflation. The CTIS shall be capable of deflation within the time constraints as listed below, (minutes: seconds). Inflation times shall not exceed the lower of those which the tire manufacturer shall provide warranty for when the vehicle is traveling at the top speed of the next highest pressure setting during inflation, or the following:

Inflation

From	**To**	**Maximum Time Allowed**
Cross-country	Highway	12:30
Mud/Snow/Sand	Cross-country	5:30
Emergency	Mud/Snow/Sand	3:00
Deflation		
Highway	Cross-country	4:00
Cross-country	Mud/Snow/Sand	4:00
Mud/Snow/Sand	Emergency	3:00

3.2.1.12 Traction Control. The vehicle shall be equipped with a traction control system. This system, under conditions of varying traction, shall be capable of shifting power to the tire(s) with the highest degree of traction, such that the tractive effort is maintained to the maximum extent possible.

3.2.1.13 Turning Requirement. The FTTS MSV shall negotiate a three-point turn within a 50-foot wide well deck or a single point turn within 80-foot wide (Threshold) 72-foot wide (Objective). *(Ref. FTTS MSV CDD 4.1.2.4.11)*

3.2.1.14 Lane Changing. The vehicle at GVW shall be capable of making a lane change in accordance with AVTP 03-160W at speeds up to TBD mph (threshold), TBD mph (objective). The vehicle and companion trailer at GCW shall be capable of making a lane change in accordance with AVTP 03-160W at speeds up to 40 mph (threshold), 45 mph (objective).

3.2.1.15 Power Take-Off (PTO) Openings. The vehicle shall provide PTO on all variants. PTO openings shall be provided and independent of transmission operation. The PTO locations shall be of sufficient capacity to deliver a minimum of 150 hp. The PTO will be suitable for power assisted semi-trailer axles that would be driven hydraulically from this PTO. *(Ref. FTTS MSV CDD 4.1.2.5.10)Further Investigation.*

3.2.1.16 Steerable/Lockable Rear Axle. If a steerable rear axle is used on the vehicles, a locked neutral steer position shall be provided at speeds over 20 MPH. Transitions to and from the neutral steer position shall not adversely affects the handling of the vehicle. In the event of a rear steer system failure; the rear axles shall assume a neutral, locked position.

3.2.1.17 Emissions. New production vehicles shall comply with Environmental Protection Agency (EPA) emission regulations/standards for new motor vehicles and new motor vehicle engines in affect at time of production.

3.2.1.18 Power Generation.

3.2.1.18.1 DC Power Source. The DC power generating system shall be capable, at engine idle speed, of charging the batteries as quickly as practicable while simultaneously supplying power equivalent to 200 amperes, 28 Volts DC, for all the other vehicle subsystems. Provisions shall be made to conveniently increase available power to these subsystems to a level equivalent to 400 Ampere at 28 Volts DC. *(Ref. FTTS MSV CDD 6.1.2.5.5.5)*

3.2.1.18.2 AC Power Source. A 110 Volts AC power source delivering at least 2,500 Watts of continuous output at vehicle engine idle speed shall be provided. Ac power source shall be integral to the vehicle and shall include outlets, protection, and distribution components. PM MEP

3.2.1.18.3 Slave Receptacle. A NATO electrical slave receptacle with electrical capability to jump-start vehicles with 24 volt systems shall be provided. *(Ref. FTTS MSV CDD 4.1.2.5.5.1)*

3.2.1.18.4 Depleted Battery Engine Start. The FTTS MSV shall contain a system that precludes loss of battery power required to start the engine under all environmental conditions exclusive of the slave starting capability provided by the existing NATO Slave Receptacle. *(Ref. FTTS MSV CDD 4.1.2.5.5.7)*

3.2.1.18.5 Extended Electrical Capability/Capacity. When applicable, vehicle power generation and management shall be provided to power weapons systems, Army Battle Command System (ABCS), and/or support systems and to recharge Mounted Warrior Soldier System (MWSS) equipment by providing at least 33 kilowatts (kW) (Threshold) 80 kW (Objective) of AC for internal and external operational power demands. *(Ref. FTTS MSV CDD 4.1.2.5.6)*

3.2.1.18.6 Energy Storage. Energy storage devices shall be maintenance free and shall be of sufficient power to meet the demand of the vehicle subsystems in all climatic conditions. Any battery shall be readily accessible for service and shall be protected from the environment.

The energy storage shall be insulated to prevent short circuiting during maintenance and operation. The energy storage shall not be located in the cab or vented into the cab. Battery enclosures shall be designed to preclude major systems damage or serious personnel injury in the event of a violent gas venting or rupture of battery cells causing high pressure within the box. Battery modules terminal connectors shall be of such material as to prevent terminal corrosion while maintaining good conductivity. A battery management system with appropriate sensors shall be provided to optimize battery charging, to monitor battery performance, and to perform battery thermal management functions. The battery management system shall allow for the replacement of a single battery module at field level maintenance without power degradation or special tools. The replacement/repair of all energy storage components shall be accomplished by field level maintainers. *(Ref. FTTS MSV CDD 4.1.2.5.5.6, FTTS MSV CDD 4.1.2.5.5.7)*

3.2.1.19 Silent Watch Capability. All FTTS MSV versions, without the power unit operating, shall have the capability of supplying 1.5 kW continuous electrical power usage for 4 hours (threshold), 8 hours (objective) without using the engine.

3.2.2 Operational Range.

3.2.2.1 Range. The FTTS MSV shall be capable of operating on internally carried fuel for a minimum distance of at least 600 miles (Threshold) 900 miles (Objective), at GVW across the OMS/MP and FTTS drive cycles. Onboard fuel storage shall not exceed 160 gallons (threshold), 60 gallons (objective). Internally carried fuel includes all fuel tanks at no more than 95 percent full, with 5 percent allowed for ullage. The FTTS MSV shall be capable of operating for an additional distance of at least 100 statute miles with the additional fuel reserves carried in standard Army containers and transported externally on mounting brackets provided as a kit. *(Ref. FTTS MSV CDD 4.1.2.4.9)*

3.2.3 Standard Obstacles.

3.2.3.1 Vertical Step. The FTTS MSV at GCW shall be capable of stepping up and down a vertical obstacle of 24 inches (Threshold) or 32 inches (Objective) in forward and reverse without preparation or modification of the vehicle. *(Ref. FTTS MSV CDD 4.1.2.4.3)*

3.2.3.2 Trench Crossing. The FTTS MSV at GCW must be capable of crossing trenches with a width of no less than 59 inches in forward and reverse without preparation. (*Ref. FTTS MSV CDD 4.1.2.4.11*)

3.2.3.3 Fording. The FTTS MSV and its companion trailer shall ford a 48″ (Threshold) or 60″ with kit, without kit(Objective) deep-water obstacle without preparation, special kits, or other fording device in forward and reverse while maintaining contact with the ground. (*Ref. FTTS MSV CDD 4.1.2.4.5*)

3.2.4 Towing.

3.2.4.1 Like Vehicle Towing. The FTTS MSV at GVW shall be capable of towing any other FTTS MSV/UV at GVW (Threshold) (GCW – Objective) over the FTTS MSV mission terrain profile using a standard Army heavy duty

tow bar. Reduced speed of 15 percent for this operation is acceptable. *(Ref. FTTS MSV CDD 4.1.2.5.13.1)*

3.2.4.2 Reserved.

3.2.4.3 Recovery/Towing. The FTTS MSV shall be capable of being recovered/lift and flat towed from both the front (at GCW) and rear (at GVW) by all wrecker systems, existing and emerging, with no disassembly required. The towing vehicle shall be able to maintain active control of the towed vehicle's braking system. *(Ref. FTTS MSV CDD 4.1.2.5.13.3)*

3.2.4.4 Towed Load Capability.

3.2.4.4.1 Companion Trailer. The primary towed load for the FTTS MSV is the Companion Trailer (CT) and is described by section 3.9.

3.2.4.4.2 Backward Compatibility. The FTTS MSV shall also be able to safely tow, over the FTTS MSV OMS/MP. *(Ref. FTTS MSV CDD 4.1.2.1.2.6.2)*

3.2.4.5 Towed Load Power & Control. The FTTS MSV shall be capable of providing power and active control of the towed load. *(Ref. FTTS MSV CDD 4.1.2.1.2.6.4)*

3.2.4.6 Reserved.

3.2.4.7 Tow Eyes. Tow eyes on the FTTS MSV must be of sufficient strength to withstand the maximum forces encountered while being used for towing and winch recovery operations. The tow eyes shall be of a size such that the vehicle can be towed with the heavy-duty towbar described on dwg 12322663. Towing shackles shall be provided with the towing eyes. *(Ref. FTTS MSV CDD 4.1.2.4.16)*

3.2.4.8 Backing. The FTTS MSV shall be capable of interfacing with the backing assist device of the M1076.

3.2.4.9 Pintle. A pintle shall be provided which permits a single operator to hook-up to a FTTS companion trailer and M1076 PLS trailer (Threshold), all lunette equipped medium/heavy trailers (Objective) or without the need for exact truck-trailer alignment (threshold), with only one mount/dismount by the operator. Hook-up shall be with the trailer tongue offset laterally up to 12 to 18 inches from the centerline of the truck and 12 to 18 inches aft of the towing position and shall not impede the turning radius of the truck and trailer combination. The pintle shall be capable of towing all pintle style trailers in common use with 5 and l0 ton vehicles (M1061, M1073, M989) (objective). A towing pintle at the rear of the vehicle shall be furnished. The assembly shall be furnished with mounting flanges and lubrication fitting. The pintle assembly mounting surface shall be forward but not more than 4 inches forward of the rear most part of the vehicle. The mounting of the pintle assembly shall include reinforcements to transfer pintle loads directly to the web of the chassis frame. Provision for attachment of trailer safety chains shall be provided as per SAE J849 (per truck installation note) for single axle trailers to be compatible with the M989 trailer that requires a one-inch safety chain bracket pin. Pintle height shall be appropriate to accommodate the following trailers with towbar height inches as listed: M332 (33-3/8), HEMAT (32-1/2 to 40)(Objective).

3.2.4.9.1 Second Pintle. The FTTS MSV shall have the capability to mount a second pintle on the front of the vehicle. The pintle may be demountable for use on both front and rear of the vehicle. *(Ref. FTTS MSV CDD 4.1.2.1.2.6.5)*

3.3 SURVIVABILITY. See Classified Annex G

3.4 TRANSPORTABILITY.
The FTTS MSV and its companion trailer shall be transportable worldwide without disassembly and without shoring at its GCW by air on USAF C-130, USAF C-17, and C-5 cargo aircraft and by highway, rail, and water without exceeding any of their peacetime operational limits. Criteria for transporting in USAF cargo aircraft are defined in MIL-HDBK-1791, as referenced in MIL-STD-1366. When configured for transport, the vehicles shall fit within U.S. and NATO transport envelopes defined in MIL-STD-1366. The MSV shall be transportable on C-130 profile aircraft, in accordance with the MTMCTEA C-130 White Paper, maritime prepositioned ships, rail and ground transport (threshold)/all current strategic or tactical transport aircraft and shallow-draft, high-speed, sealift and landing craft (objective). The MSV shall be C-5 and C-17 transportable to support intertheater deployment and C-17 and C-130 transportable to support intratheater operational maneuver.

3.4.1 Weight Limitations. The MSV shall be transportable by up-armored C-130–profile aircraft without waiver at a weight no greater than 18.1 Short Tons (ST) including a 4 ST payload (Threshold), 6 ST payload (Objective). The MSV shall not exceed at any time during loading or flight an axle load of 13,000 lb or a tire pressure of 100 psi. All MSV shall be capable of onboard, automatic weight, axle-load, and center-of-gravity calculation.

3.4.2 Size Limitation. The height of the vehicle at the front and rear shall be limited to 95 in, sloping to full height at least 36 in onboard from the end.

3.4.3 Lifting & Tie-Down Provisions. FTTS MSVs and Companion Trailers shall be securable to the floor or deck of transport craft. Lifting and tie-down provisions (both vehicle and cargo) shall be in accordance with IAW MIL-STD-209 and shall be permanently marked (threshold). Lift and tie-down provisions shall be sized for full GVW and shall not interfere with the payload of the vehicle.

3.4.3.1 Lifting Eyes. Two lifting eyes shall be installed on both the front and rear of the FTTS MSV. Each lifting eye and its mounting shall withstand a load of at least 60,000 pounds without failure or permanent deformation when the load is applied at an angle up to 45 degrees from the longitudinal axis.

3.4.4 C-130 Air Transport. One FTTS MSV or its companion trailer shall be C-130 transportable in a single aircraft sortie at a total weight not to exceed 18.1 short tons. The MSV (Threshold) or companion trailer (Objective) shall be roll-on/roll-off transportable under its own power by all cargo versions of the USAF up-armored C-130 aircraft models E through J. No shoring of any type shall be allowed. *(Ref. FTTS MSV CDD 4.1.2.3.5)*

3.4.4.1 C-130 Ramp. The MSV shall be capable of negotiating the worst case C-130 ramp angle of 15 deg by the roll-on/roll-off method, without ramp approach shoring and without any portion, except the tires, of the vehicle contacting the surface of the ground, ramp, or aircraft cargo compartment floor. A minimum 1-in clearance between all components of the FTTS (excluding the tires) and the C-130 ramp, floor, and the ground shall be maintained.

3.4.4.2 Preparation Time. The FTTS MSV and its payload shall not require more than 15 total minutes by the operator with on-board tools and equipment to prepare for embarkation or debarkation on any form of transport (air, land, or sea) (threshold), 0 minutes/no tools (objective). *(Ref. FTTS MSV CDD 4.1.2.3.7)*

3.4.5 C-5 Air Transport. Up to three MSVs at GVW or one at GCW shall be roll-on/roll-off transportable under their own power, without disassembly, by all cargo versions of the USAF C-5 aircraft. No shoring of any type shall be allowed. The MSV shall not exceed any of the C-5 design limits as defined in MIL-HDBK–1791 and referenced in MIL-STD-1366. *(Ref. FTTS MSV CDD 4.1.2.3.5)*

3.4.6 C-17 Air Transport. Up to two MSVs(threshold) and three MSVs (objective) at GVW or one at GCW shall be roll-on/roll-off transportable under its own power, without disassembly, by all cargo versions of the USAF C-17 aircraft at 130,000 lbs. No shoring of any type shall be allowed. *(Ref. FTTS MSV CDD 4.1.2.3.5)*

3.4.7 Commercial Transport. The MSV shall meet the Army force deployment guidelines (threshold)/be capable of transport on commercial contracted airframes and vessels in accordance with the Civil Reserve Air Fleet (CRAF) guidelines and the Voluntary Intermodal Shipping Agreement (VISA) (objective).

3.4.8 Highway Transport. The MSV shall not exceed highway permit limits, either when operated as a self-propelled vehicle or when carried as cargo by highway transportation assets of the Army, NATO, or allied countries. All MSV shall not exceed highway weight and dimensional permit limits. This requirement applies to all self-propelled vehicles and those carried as cargo by Army highway

transportation assets in CONUS and NATO countries, as detailed in MIL-STD-1366.

3.4.9 Rail Transport. All towing/towed vehicles shall be capable of being transported attached to their towed/towing vehicle (prime mover). The MSV, when loaded on 51-in deck-height railcars, shall meet the dimensional requirements of the Association of American Railroads (AAR) "Outline Diagram for Single Loads, Without End Overhang, on Open Top Cars" (covered in MIL-STD-1366) and the *Gabarit International de Chargement* (GIC) gauge shown in MIL-STD-1366 and NATO Standardization Agreement (STANAG) 2832. This requirement applies to the standard gauge rail lines in CONUS and in NATO countries. Any disassembly of the MSV will not be permitted.

3.4.10 Water Transport. The MSV shall be capable of negotiating 15-deg ramps without any portion of the vehicle, except the tires, contacting the surface of the ground, ramp, or deck (threshold). Shoring will not be allowed as a solution to meeting the ramp angle requirement (objective). All MSV shall be transported without disassembly on all classes of ocean-going ships, including breakbulk (general cargo), roll-on/roll-off, barge carrying (LASH and SEABEE), and on all vessels of Army, Navy, and Marine Corps tactical watercraft fleet, in accordance with MIL-STD-1366.

3.4.11 Hazardous Material Transport. FTTS MSV and MSV CT shall meet all CONUS, OCONUS and NATO highway safety requirements for the transport of class VIII (medical), class III (POL), class V (ammunition and missiles) where applicable.

3.5 VEHICLE COMMAND, CONTROL, COMMUNICATIONS, COMPUTERS & INTELLIGENCE (C4I).

3.5.1.1 Common Information Systems. The system must interface with the COP (Common Operating Picture) and Defense Transportation System (DTS) to allow the Joint Task Force (JTF) to adjust responsiveness and adapt to a dynamic Joint Operational Area (JOA). *(Ref. FTTS MSV CDD 4.1.2.2.3)*

3.5.1.2 Reserved.

3.5.1.3 Common Relevant Operating Picture (CROP). The FTTS shall integrate with the (CROP) via embedded C4I equipment on the FTTS MSV to include different types of suites, architectures, network peripherals, subsystems, and radios. The FTTS MSV shall have sufficient space and power for on-board integration of C4ISR systems without inhibiting any vehicle operation by any operator within the cab space of the FTTS MSV (to include line of sight, safety issues, MANPRINT, ergonomics, etc…) or without using room dedicated for TA-50, individual weapons, rucksack/backpack storage, crew gear, duffle bags, or other cab occupant belongings. *(Ref. FTTS MSV CDD 4.1.2.2.5)*

3.5.1.4 Embedded Readiness System. FTTS MSV must incorporate an embedded mission readiness system compatible with FCS. This system will monitor the status of mission-critical components/subsystems (including the crew) and consumables. If a condition is detected that

degrades mission capability, the embedded system will determine what action (repair, resupply, crew rest period, etc.) is required to restore full mission capability. The embedded mission readiness system will interface with the crew operating station and the C4ISR system to provide required status reports and alerts IAW reporting criteria set by the operational commander. The embedded readiness system will include the capability to forecast the future state of the FTTS system on which it is located. It will forecast equipment degradation/failure using prognostics algorithms and data from embedded sensors and operating maintenance logs. *(Ref. FTTS MSV CDD 4.1.2.8.3)*

3.5.1.5 Sustainment Data & Reporting. FTTS systems must be capable of automatically monitoring, collecting, storing and reporting real-time cargo (payload) and maintenance data (Non-real time sensitive data will remain stored on board for downloading as required) from the platform/system level sensors, analyze critical sustainment data, record and report automatically to the battle command node, or upon request report to other systems or organizations as required and display it to the crew as needed (Threshold). The FTTS MSV must also be capable of integrating sustainment data from non-FTTS MSV equipment in the UA. When connected to approved Army/Joint C4ISR systems this data must be capable of automatic distribution through them as required to maintain the current relevant COP, Common Logistics Environment (CLOE) and Log status at all levels. *(Ref. FTTS MSV CDD 4.1.2.8.4)*

3.5.1.6 External Interfaces. Vetronics computing hardware and software shall be compatible with and interoperate with other onboard computing hardware and software including FBCB2 and MTS. Such hardware includes interfaces to the crew station, other crew workstations, dismounted soldier equipment (mounted warrior soldier system), C4ISR computing/communications equipment, and other vehicle subsystems (e.g., propulsion, survivability, lethality).

3.5.1.7 Objective Performance (OP) C4I Hardware Package. The contractor shall, as a minimum, incorporate the following components into the MSV Objective Performance (OP) designs as representative space and weight claims for C4I hardware that is currently under development in the Future Combat Systems (FCS) program.

Common Part Name	Weight		Dimensions					
	lb	kgs	length		width		height	
			in.	mm	in.	mm	in.	mm
Joint Tactical Radio System (JTRS)	43	20	13.5	343	15.3	389	7.5	191
Joint Tactical Radio System (JTRS)	43	20	13.5	343	15.3	389	7.5	191
Camera-Rear	30	14	10.25	260	4	102	3.75	95
Camera-Front	30	14	10.25	260	4	102	3.75	95
Combat ID Processor (IFF)	10	5	6.4	163	5.7	145	8.2	208
Combat ID Transceiver (IFF)	7	3	5	127	9	229	8	203
C4I Computer 1	67	30	21.6	549	11	279	10.125	257
C4I Computer 2	67	30	21.6	549	11	279	10.125	257
C4I Computer 3	65	30	21.6	549	11	279	10.125	257
Cosite Interface Mitigation Dev	50	23	8	203	15.75	400	13.75	349
Cosite Interface Mitiagtion Dev	50	23	8	203	15.75	400	13.75	349
Universal Hd Power Amp in Mount	3	1	9.65	245	5.88	149	7	178
Universal HDC Power Amp in Mount	3	1	9.65	245	5.88	149	7	178
Universal Hd Power Amp in Mount	3	1	9.65	245	5.88	149	7	178
Universal Hd Power Amp in Mount	3	1	9.65	245	5.88	149	7	178
JTRS Remote Control Head	2.1	1	3.75	95	5.75	146	1.75	44
Software Loader Verify	1.75	1	1.8	46	7.5	191	5.25	133
Software Loader Verify (delete this one)	1.75	1	1.8	46	7.5	191	5.25	133
R2 Data Storage Unit Removable	10	5	10	254	5.75	146	4.5	114
R2 Data Storage Unit Removable (delete th	10	5	10	254	5.75	146	4.5	114
Multiple Antenna Array	22	10	24	610	24	610	7.5	191
Multiple Antenna Array	22	10	24	610	24	610	7.5	191
Whip Antenna	8	4		0		0	42	1067
Whip Antenna	8	4		0		0	42	1067
Automatic RF Distribution	25	11	10	254	19	483	5.25	133
Automatic RF Distribution	25	11	10	254	19	483	5.25	133

3.5.2 Minimum Demonstrator C4I Functionality. Because of the expected unavailability of the hardware listed above and the requirement to demonstrate improved C4I capabilities for the ACTD, the contractor shall provide the following minimum C4I functionality. The contractor is not limited to providing only this level of C4I functionality.

3.5.2.1 Force XXI Battle Command Brigade & Below. The FTTS must automatically collect critical sustainment data and have the capability to report sustainment data automatically, or upon request report to other systems or organizations as required and display it to the crew as needed (Threshold). *(Ref. FTTS MSV CDD 4.1.2.9.19.1)*

3.5.2.2 Movement Tracking System (MTS). The system shall allow the Government to track its assets worldwide. The FTTS must also be capable of integrating sustainment data from FCS FoS equipment in the UA. When connected to approved Army/Joint C4ISR systems this data must be capable of automatic distribution through them as required to maintain the current relevant, common logistics environment and log status at all levels.

3.5.2.3 En Route Mission Planning & Rehearsal System. The FTTS information system shall provide UAs down to the battalion nodes (threshold)/all MSVs (including the individual soldier) (objective) the ability to integrate into the EMPRS from alert through deployment to

employment and connectivity into the gaining C2 architectures during movement by air, land, and sea.

3.5.3 Electrical System. Electrical system shall be in accordance with Federal Motor Carrier Safety Regulations 393.27 through 393.33. Variants shall be equipped with a 24 VDC electrical system with either a 12 VDC lighting system or a 24 VDC lighting system. Electrical systems shall be waterproof with the exception of components and connections inside the cab or other enclosures. Circuits and components shall be protected from corrosion by the use of corrosion resisting materials or by the application of corrosion resisting compound that is readily removable for maintenance. The 24 VDC electrical circuits shall conform to the limits prescribed in MIL-STD-1275. Reverse polarity and over-voltage protection shall be incorporated into all electrical systems. All manual circuit breakers shall be readily accessible to facilitate manual resetting. Circuits shall be identified with the contractor's code for electrical wiring and electrical components. A manually operated, keyless ignition switch with “off”, “on” and “start” positions shall be provided. *(Ref. FTTS MSV CDD 4.1.2.5.5.1)*

3.5.3.1 System Grounding. Vetronics equipment shall adhere to the following power, grounding, signal interfacing, and shielding guidelines:

a. Equipment design for FTTS requiring 28-V dc vehicle power shall be compliant with MIL-STD-1275 and E38249. All equipment shall be designed with separate power input(s) and power return(s) (two-wire circuit). Vehicle chassis should not be used as a power return.
b. Vetronics equipment power returns shall be connected to a single-point ground location.
c. Equipment vehicle power returns and signal returns shall be electrically isolated from the equipment chassis.
d. Equipment chassis shall be electrically bonded to the vehicle structure.
e. DC returns distributed from vetronics equipment shall not be interconnected with other dc returns without first providing isolation.
f. The data network and the test and maintenance bus will be the only interfaces connected directly to multiple processor units.
g. When connecting signal interfaces between processors and other vetronics entities, the following types of interfaces should be used in the order listed:
    1. Fiber optic.
    2. Differential signals with transformer coupling and isolated grounds.
    3. Differential signals with dc coupling and single-point ground at the station.
    4. Single-ended signals with optical coupling and isolated grounds.
    5. Single-ended signals with dc coupling and single-point ground at the processor.
h. Cables shall have an overall shield connected to the equipment chassis at each piece of equipment connected to the cable in accordance with practices and procedures defined by relevant E3 specifications.

i. Signals requiring individual shields within a cable shall have their shields connected to equipment terminated in accordance with practices and procedures defined by relevant E3 specifications.
j. Shielding shall not be pinned through a connector.

3.5.3.2 Electrical Accessories.

3.5.3.2.1 Meals Ready to Eat (MRE) Outlet. A minimum of one dedicated Meals Ready to Eat MRE/Water Heater outlet, and a minimum of 3 convenience outlets (12/24v including on/off switch) shall be provided as a power source for portable electrical equipment. The MRE/Water Heater shall be mounted in a location to discourage use during vehicle movement. A grounding circuit shall be autonomous and separate from the chassis. *(Ref. FTTS MSV CDD 4.1.2.5.5.3)*

3.5.3.2.2 110 V AC Electrical Power Location. Electrical power source outlets for 110v AC shall be provided in the cargo compartment with minimum interference with the cargo (Objective).

3.5.3.2.3 Power & Data Growth Capability. Provisions must be made for the wiring (power and data) of future systems that may be mounted on the FTTS MSV.

3.5.4 Vehicle Management Software. The vehicle management function shall be implemented in software that executes on general-purpose processors dedicated to vehicle control. The function shall provide a standard status and control data interface to all vehicle and mission subsystems. The vehicle management function shall provide the interface between C4ISR systems and the vehicle subsystems.

The vehicle management functional and performance requirements are divided into three segments:
1. Vehicle operational management.
2. Vehicle safety management.
3. Vehicle reporting.

3.5.4.1 Vehicle Operational Management. Vehicle operational management complements the overall requirements for vehicle capability. Vehicle operational management shall provide the functionality and performance covered in the paragraphs below.

3.5.4.1.1 Failure Detection & Recovery. Failure detection and recovery shall support the detection of failure in the primary vehicle control GPP and the control-switching schema to the backup General Purpose Processor (GPP). Failed and successful switchover results shall be made available for display to the crew station.

3.5.4.1.2 Initialization. Initialization shall check vehicle electronics operational readiness and initialize the vehicle management software to the desired state defined in section 3.1.1.

3.5.4.1.3 C4ISR Computer Startup. The vehicle management function shall turn on the C4ISR computer. Startup of the C4ISR system will be initiated by C4ISR organic software.

3.5.4.1.4 Software-Enabled Vehicle Control. The primary implementation of vehicle control functions shall be through software. In essence, this expects that the closed-loop control between sensors and actuators is implemented in software.

Appropriate characteristics of the software-based control shall be parameterized to allow changing vehicle performance without rewriting software. An implementation of this can be accomplished with tunable performance parameters being represented as data.

The vehicle control software shall allow other software components and/or crews to change vehicle performance. The vehicle control software shall not allow vehicle control inputs outside of vehicle performance capabilities.

The vehicle control software shall enforce predefined limits consistent with mission profiles and safety and security policies.

3.5.4.1.5 Automation & Semi Automation Support. The software shall be constructed to allow the automation and/or semi automation of tasks and sequencing of tasks. An example is supporting script-based control of software functions.

3.5.4.1.6 Sensor Control Support. The vehicle management software shall support sensor control actions with respect to enabling or disabling interlocks on sensors.

3.5.4.1.7 Vehicle Safety Management. Vehicle safety management is part of the overall safety system. MSV subsystems shall not introduce any uncontrolled safety hazards to the host platform.

3.5.4.1.8 Status Acquisition & Control. Status acquisition and control shall nominally provide fixed (4-Hz) monitoring and control of all vehicle and mission subsystems. The vehicle management function shall monitor and provide control as required and control changes commanded no more frequently than 1 time per 0.100 sec.

3.5.4.1.9 Reporting. Reporting shall enable C4ISR, C2, training, and sustainability applications to receive information about vehicle and mission subsystems health and status and from the vehicle management software. Reporting shall

a. Extend for no longer than 1 sec during battle conditions.
b. Provide integrated vehicle health and status reports at rates up to 5 Hz.
c. Provide mission subsystems status reports at rates up to 5 Hz.
d. Provide alarm reports at rates up to 10 Hz, by exception.
e. FTTS MSV shall have sensors which collect and transmit fuel on-board, potable water on-board, and rations on-board. *(Ref. FTTS MSV CDD 4.1.2.5.1)*
f. FTTS Manned Systems must provide interfaces necessary to support the LWFCS and Mounted Warrior (MW) physiological monitoring systems to report Soldier medical status when mounted or dismounted. (Objective) *(Ref. FTTS MSV CDD 4.1.2.7.13)*

Reporting using the publish service shall extend for no longer than 1 second per request during battle conditions.

3.5.5 Lighting. All clearance lights, marker lights and military composite lights shall be LED (threshold). All interior lighting shall be LED (threshold). The vehicle exterior and interior lights shall be protected to preclude any damage when interfacing with other vehicles or ancillary equipment and shall be protected from terrain and natural obstacles while traveling cross-country. The vehicle shall be equipped with lamps, reflective devices, and associated equipment as specified per FMVSS 571.108. Actuation of the brakes shall override the vehicle hazard lights. All indicators and gauges shall be illuminated in service mode.

3.5.5.1 Headlights. The FTTS MSV shall incorporate headlights. The headlight height requirements in FMVSS 571.108 do not apply. Headlights shall meet DOT illumination requirements; 24-volt headlights are permitted.

3.5.5.2 Exterior Work lamps. The FTTS MSV shall be equipped with a minimum of 2 permanently mounted work lamps to facilitate night operation and maintenance and meet the requirements below:

a. Lamp housing shall be mounted in a protected position and such that the lamps are aimed at areas around the rear and sides of the vehicle.
b. The work lamps shall provide a minimum of 1,500 candlepower (c.p.) and equipped with an individual on/off switch plus a master switch in the vehicle cab accessible to the driver.
c. An on/off switch accessible from the driver's position shall be furnished and operate individually from the light itself.
d. 2 additional work lamps (threshold) that shall be demountable and provide the capability to permit hand illumination of the truck pintle areas and 20 ft. beyond.

3.5.5.3 Convoy Warning Lights. There shall be provisions for readily mounting and connecting a commercial, yellow strobe type warning light on the vehicle. The strobe light shall have a light intensity equal to or greater than warning light A-A-52418. The warning light shall be visible for 360 degrees and shall not be capable of being activated during the blackout mode.

3.5.5.4 Secure lighting. A 24 VDC or 12 VDC blackout lighting system shall be furnished. The blackout system shall be controlled by an interior switch, readily accessible to the driver, which shall prevent accidental disengagement of the blackout system from the blackout mode and shall automatically disengage all lights and devices required by paragraph 3.5.5, 3.5.5.1, 3.5.5.2, 3.5.5.3, the backup alarm (see 3.5.12). Exterior blackout lighting shall consist of, either separately mounted or in a composite light assembly, one blackout drive lamp (reference 12360910), and two rear mounted blackout stop lamp assemblies (reference 12360870). Interior blackout lighting shall be as required for safe operation of the vehicle and compatible with night vision devices (i.e. night goggles) in use at time of fielding. The emission of any vehicle interior or exterior light source, which may be illuminated (including warning lights) in the blackout mode, shall be limited to the visible spectrum (380 to 700 nanometers). No energy shall be emitted in the 700 to 1200-nanometer portion of the electromagnetic (EM) spectrum. (Emission peaks shall not exceed 1% relative to the peak emission in the visible spectrum.) Colored

warning lights shall be maintained as necessary while meeting the above requirements. *(Ref. FTTS MSV CDD 4.1.5.5.2)*

3.5.6 Wiring. All wiring shall be in accordance with SAE-J1292 and SAE-J163. Unless otherwise specified herein, wiring not protected from accidental contact with troops, terrain or vegetation shall be a minimum of 14 gauge. Vehicle junction boxes/connectors shall be furnished at multiple disconnect points.

3.5.7 Reserved.

3.5.8 Electrical Connectors. All electrical connector bodies, pins and contacts shall be made of corrosion resistant material or shall be coated with a corrosion resistant material that is readily removable for maintenance. The vehicle shall be equipped with all connectors necessary to operate electrical components of towed military trailers. Connectors shall allow for disconnection and reconnection without damage. Inter-vehicle slaving connections will be accomplished through cable and plug assembly. The slave receptacle shall be located so as to preclude damage, corrosion and contamination. The receptacle cover shall stay in place under all mission scenarios. A 7-pin connector conforming to SAE J560 shall be located at the front and rear of the vehicle and shall be integrated with the 12 volt lighting system. A 12-pin NATO STANAG 4007 connector shall be located at the rear of the vehicle and shall be integrated into the blackout lighting system. Waterproof, shelled connectors shall be utilized for all electrical connectors.

3.5.9 Crew Indicators. The vehicle shall be equipped with gauges/indicators, which shall be readily visible to the driver/assistant driver and illuminated for night operation. Gauges may be replaced by an on board message center. Gauges/indicator shall include as a minimum, fuel level, engine coolant temperature, transmission fluid temperature, engine oil pressure, engine tachometer, speedometer/odometer, power management suite, air pressure (air assist vehicle/trailer brakes), brake warning, park brake on and air filter gauge and Power Take-Off (PTO) engagement light. The speedometer shall be calibrated in both MPH and KPH. An odometer shall be provided to indicate mileage and kilometers. Warning lights shall be provided and shall include, engine temperature, headlight high beam, emergency brake engaged and an ABS error indicator (as applicable). There shall be a warning light and an audible warning to indicate low air pressure, and high coolant temperature. The audible warning indicators shall be inactive while in the blackout mode. There shall also be self canceling turn indicators, emergency flasher system, light switch which controls service lights, blackout lights, driving and instrument panel lights. Gauges and switches shall be color coded on the face scale indicators to indicate information such as: desirable operating range in green; cautious, undesirable, or ineffective usage in yellow; dangerous or harmful operating level in red. Lenses shall not discolor throughout the life of the vehicle. Two map lights with one located in each upper rear corner of the cab with individual switches shall be provided. These lights shall be overridden during blackout mode.

3.5.9.1 Master Power Cutoff Switch. The vehicle shall be equipped with a master power cutoff switch that, when activated, disconnects power to

all systems in the truck and towed trailer. The switch shall be capable of handling all electrical systems. Switch shall have a failsafe system that prevents damage for shutoff.

3.5.10 Databus Connectors. The vehicle data bus(s) shall be defined by the subsystems employed (i.e. SAE J1708, J1939, J1850 or MIL-STD-1553). The connectors shall be standard 9-pin DDL type (Military connector 10). Databus-sensor connections shall interface with the engine, transmission, antilock brake system, Central Tire Inflation System and as many other electronic subsystems as possible.

3.5.11 Data Storage. The vehicle shall be equipped with a system that shall be capable of accumulating, recording, and storing (30 (threshold)/90 days (objective)) vehicle diagnostics, prognostics, and operational data such as coolant temperature, oil temperature, oil pressure, throttle position, speed, timing, fuel pressure and vehicle speed. The data shall be protected by security measures from tampering.

3.5.12 Interrogation Capabilities. The FTTS will have vehicle-to-vehicle diagnostics interrogation and data collection capabilities (mechanical-threshold; wireless-objective) enabling the operator and/or Combat Repair Team (CRT) to diagnose vehicle failures without leaving their vehicle and without ancillary Test Maintenance and Diagnostic Equipment (TMDE). *(Ref. FTTS MSV CDD 4.1.2.9.9)*

3.5.13 Vehicle Backup Alarm. The FTTS will have a backup alarm that shall be installed on the vehicle in accordance with SAE J994 requirements. The crew shall have a control to disable this function.

3.5.14 Identifying Friend or Foe (IFF) Devices. FTTS must provide combat identification (CID) of friend or unknown in a Joint, Allied/Coalition environment through platform-to-platform (manned and unmanned, ground and air), platform-to-soldier, soldier-to-platform and soldier-to-soldier under all battlefield and weather conditions across the spectrum of operations. CID systems must interface with the C4ISR communications network for development and maintenance of the COP. *(Ref. FTTS MSV CDD 4.1.2.7.12)*

3.5.15 Driver's Vision Enhancements.

3.5.15.1 Night Vision Enhancer. An integrated driver's vision enhancement which improves vision in all obscure conditions (e.g. snow, fog, dust, smoke, etc.) shall be provided. *(Ref. FTTS MSV CDD 4.1.2.5.8)*

3.6 RELIABILITY, AVAILABILITY, MAINTAINABILITY, & DURABILITY (RAM&D).

3.6.1 Reliability. In order to meet self-contained sustainment of the UA for periods of 3-day and/or 7-day mission pulse throughout the full spectrum of combat requirements for the FTTS MSV, it is imperative that platforms/vehicles achieve the mission reliability requirements. Commanders and their soldiers will have the confidence that systems will not fail during mission execution or, if they do, that they can be quickly and easily returned to combat effectiveness.

The extremely high system-level reliability of the FTTS MSV platform coupled with a trained operator/maintainer is essential to make

platform availability goals. It is through inherent, high reliability and maintainability that the UA is able to meet its operational goals with a smaller force and logistics footprint.

3.6.1.1 Mean Time Between System Aborts. System abort failures are defined as failures (operational hardware and software) that render the system non-mission-capable, including the network causing the associated platform/vehicle to become unable to continue in service, deadline the platform, or platform operation becomes unsafe. Non-mission-capable shall be defined (at a minimum) as loss of any of the following functions:

a. Mobility.
b. Survivability.
c. Command, control, communications, and computers.
d. Distribution capability (LHS).

This state is entered when a FTTS MSV system or subsystem fails so that operations and mission capabilities are not maintained.

This state is also entered when any failure results in a significant increase in crew workload, causing the crew to fail to successfully operate or maintain the FTTS MSV network-critical/essential functions and carry out the intended mission. MSVs shall be capable of operating 3 days under high operational tempo and 7 days under medium operational tempo without a system abort for at least 2800 hours. The MSV platform/vehicle shall meet this requirement under operation environmental conditions and per the mission profile defined herein.

To determine conformance to the reliability requirements, reliability requirements shall be demonstrated at the paragraph specified point estimate (threshold).

3.6.1.2 Mean Time Between System Aborts–Mobility. System abort–mobility failures are those failures (operational hardware and software) that render (deadline) the basic platform/vehicle mobility subsystem immobile/maneuverable, resulting in unsafe operation or making it non-mission-capable. The Mean Time Between System Aborts–Mobility (MTBSA-M) for each FTTS MSV shall be greater than or equal to 6450 hours.

3.6.1.3 Mean Time Between Essential Function Failures. Essential function failures are those failures (operational hardware and software related) that result in system degradation but still leave the platforms/vehicles in a full-mission or partial-mission-capable condition. Essential function failures also include failures that result in a significant increase in crew/operator workload. Each FTTS MSV shall have a mean time between essential function failures (MTBEFF) of not less 675 hours (Current complex systems have demonstrated a ratio of 4 EFFs for each SA).

3.6.2 Maintainability. Achieving the FTTS maintainability requirements increases available combat power and limits the maintenance force structure with respect to maintainers by

a. Ensuring that failed systems shall be rapidly returned to full combat capability.
b. Detecting impending incidents through prognostics prior to operational periods.

c. Accomplishing scheduled and unscheduled maintenance during pulse logistics periods.
d. Ensuring the success of the crew chief maintenance concept and its contribution to the reduction of logistics footprint

The FTTS MSV shall be supported by the two-level Army maintenance system, which consists of field and sustainment maintenance:
a. **Field maintenance** shall consist of on-system repair and return-to-user tasks, those tasks that do not consist of disassembly of a component (primarily LRU/line-replaceable module [LRM] level replacement). Field maintenance shall be conducted forward in the battlespace as the battle rhythm of the supported unit permits and shall be conducted by the system crew chief/operator and ordnance Combat Repair Teams (CRT) equipped with the Forward Recovery and Maintenance Vehicle (FRMV).
b. **Sustainment maintenance** shall consist of off-system repair and return-to-supply tasks, those tasks required to return components, subassemblies, and/or end item systems to a serviceable condition. Sustainment maintenance may take place at designated locations in the UE, or even as far back as CONUS, and shall be performed by military personnel, government civilians, and/or contractors.

3.6.2.1 Automation. Systems with STAMIS network communication linkage capability must monitor, receive, and transmit equipment operation, sustainment, and maintenance data. Systems designed with no communication capability will be designed with on-system sensors, data collection, storage, and down-load capability of non-time sensitive operation, sustainment, and maintenance data.

3.6.2.2 Design for Maintainer. To ensure ease of maintenance, MIL-STD-1472, Design for Maintainer section, shall be used appropriately to ensure that the system is designed for compatibility with human maintainers wearing full combat weather equipment. MIL-HDBK-759 shall be used to calculate anthropometrical dimensions. Where arm, hand, and thumb-finger controls requiring high control forces are to be used, the maximum force requirements shall not exceed those specified in MIL-STD-1472.

3.6.2.2.1 Component Accessibility and Identification. Components shall utilize only those tools used in 3.6.2.10.4. All reservoirs, filters, drains, vents and valves shall be easily accessible and identified for inspection and servicing. Drain plugs installed in engine, transmission, transfer case, axles, and hydraulic reservoir shall be of the permanent magnet type and readily accessible. The function of all drains, vents and valve openings shall not adversely affect the function of or damage to any other vehicle component (i.e. battery box). Provisions shall be in place to prevent draining fluids from contacting other components of the vehicle. All seals shall restrict the entrance of all foreign materials and prevent the leaking of lubricants. At a minimum, the engine, transmission, antilock brake system (if installed) and Central Tire Inflation System shall be electronically controlled. All lines and fittings shall be secured in such a manner to prevent rubbing on adjacent lines or vehicle appendages. The MSV shall be equipped with all items necessary to accomplish all mission objectives and tasks. The MSV shall have mounting and stowage provisions for all Basic Issue Items (BII) and

onboard tools.

3.6.2.3 Maintenance Ratio–Maintenance Man-Hours per Operating-Hour. Each FTTS MSV shall achieve the following maintainability requirement: the FTTS MSV maintenance ratio (MR) shall not exceed 0.025 maintenance man-hours per operating-hour (MMH/OH) (threshold), which includes field and sustainment maintenance tasks. The crew chief shall be able to isolate, remove, and replace 60% of all field-level failures (SA/EFF) resulting in a non-FMC system (excluding battle damage) and 60% of all field level system unscheduled failures (NEFF), without special tools or capabilities (lift). The MR includes operator/crew preventive maintenance checks and all unscheduled maintenance, preparation, inspection, diagnostics, removal, replacement of LRUs/LRMs (including software reloads/reboots), and adjustments/tests required to restore the platform/vehicle to mission-capable status. Does not include annual/9000 mile scheduled maintenance event.

3.6.2.4 Time to Repair. Each FTTS MSV shall not exceed 0.5 clock-hours Mean Time To Repair (MTTR)(Threshold), 0.25 clock-hours (Objective). Maximum Time To Repair (max TTR) for 95% of all maintenance actions. The Maximum TTR for the operator field level maintenance tasks shall not exceed 0.5 clock-hours. MTTR is the sum of all active corrective maintenance times divided by the total number of failures (SA, EFF, and non-EFF). Active repair time does not include cool down, waiting time for spares, locating ladders, getting out technical manuals, cure time for gaskets/seals, etc.

The MSV shall not exceed maximum time to repair of 0.5 hr (clock hours) for all operator field–level maintenance actions, with or without armor protection.

3.6.2.5 Preventive Maintenance Checks & Services. Preventive maintenance for the FTTS MSV shall consist of daily Preventive Maintenance Checks (PMC), annual scheduled maintenance checks and services, and anticipatory maintenance enabled by prognostics. The crew chief/operator shall perform PMC that includes required before-, during-, and after-operation checks and services. Anticipatory maintenance enabled by embedded prognostic sensors and software shall detect failure of critical components and assemblies so equipped in sufficient time to allow for replacement before failure.

3.6.2.5.1 Preventive Maintenance Checks (PMC). Each MSV shall provide the capability for automated PMC. The PMC results shall be displayed to the crew/operators. Crew/operators/maintainer shall be capable of performing PMC and capable of confirming as necessary fluid/oil levels, operation of lights, ancillaries, pressure, and any equipment wear.

Crew chief/operator PMC requirements must be automated to the maximum extent possible using onboard sensors and diagnostics to simplify checks and reduce operator workload. Non-automated portions of the PMC must require no more than 5 minutes to complete. PMC results must be displayed to the operator and critical information reported to maintenance through the MSV mission readiness system (Manned systems). Non-critical PMC data results must be stored on board by the mission readiness system for download periodically and input to the logistics management database. Unmanned systems must automatically report status

(if enabled) or report through the controlling manned MSV system. (Threshold) *(Ref. FTTS MSV CDD 4.1.2.9.3)*

3.6.2.5.2 **Scheduled Services**. MSV manned system design shall allow for a single annual, scheduled maintenance service period that meets the parameters of 9,000 mi, 3,000 operating-hours, or annually, whichever occurs first. Total time for the scheduled maintenance service shall not exceed 24 man-hours per vehicle per service with a goal of 12 man-hours per vehicle per service. Servicing shall be defined as cleaning and replacement of selected equipment. All type vehicles of this family shall be designed so that the following (if applicable) can be removed from the vehicle and replaced in less than one hour by 2 Operators or maintainers

a. Transfer Case

All type vehicles of this family shall be designed so that each of the following (if applicable) can be removed from the vehicle and replaced in under 1.75 hours by 2 operators or maintainers.

b. Engine (only)
c. Transmission (only)
d. Engine – Transmission Assembly

The criteria is from hood up to hood down and includes all preparation, i.e., hood removal, tilting the cab or draining fluids, etc. Routing, daily maintenance checks, i.e., engine oil, coolant level, battery liquid level, etc., must be readily accessible without the use of tools. Pre-operation fluid level checks shall not take longer than 5 minutes. Components of the chassis shall be accessible for servicing, repair, and replacement. Ease of maintenance provisions shall incorporate features insuring operating clearances and facilitating maintenance and service operations.

3.6.2.6 Doors & Maintenance Access. Each FTTS MSV shall provide ready accessibility compatible with the maintenance ratio requirement, for servicing, adjusting, and replacing elements of the installation without teardown of any major part, component, or element. The MSV doors and maintenance access panels shall be located such that equipment that requires more frequent maintenance is given prime locations. They shall have an automatically applied positive means of being latched in open and closed positions that prevents unintended hatch closing or opening. Access mechanisms shall be designed so that it is obvious how they open and close. Access covers that remain attached to the basic equipment shall be designed so that they do not have to be held open and do not dangle in the way. Vibration or shock during operation or the accumulation of dirt, debris, shell casings, snow, ice, and the like shall not prevent proper door and access opening function. Access openings shall be large enough so that a maintainer can see what he is doing with his hands in the opening.

3.6.2.7 Subsystem/Component Serviceability. Subsystems and components shall be designed for automatic, self-aligning, tool-less, and self-torquing installation and engagement of mountings and interconnections. Use of slides, alignment pins, captive hardware, installation levers, and similar devices shall be used to minimize human error and task

requirements for all field maintenance tasks.

3.6.2.8 Electrical Connectors. Each FCS platform/vehicle shall contain the minimum number of distinct electrical connectors interfacing with LRUs, platform/vehicle/system/subsystem/mission equipment, and the platform. Electrical/electronic connectors to be used on LRUs shall be keyed to prevent incorrect application. Electrical connectors shall be selected that provide for connection and tightening without the use of tools and with ease of installation and replacement of LRUs.

3.6.2.9 Filters. Each FTTS MSV engine shall include filtering for fuel, lubricating oil, and intake air to prevent excessive contaminants from entering the engine system. The filter assemblies shall be designed so that the filters can be conveniently and easily removed. The engine air cleaner element efficiency shall be 99.8% with SAE coarse test dust and 99.5% with SAE fine test dust.

All filters within the FTTS MSV for water, fuel, oil, hydraulic, NBC, pneumatic, and air, shall be designed with the following additional features:

a. All filters shall be directly accessible by the operator/maintainer/crew (with or without armor plating installed).
b. Health monitoring systems shall monitor the performance and life of the filters.
c. Service life of all filters shall be at least 2 years.

3.6.2.10 Prognostics & Diagnostics. Each FTTS MSV shall incorporate and enable embedded prognostics and embedded diagnostics that identify down to the LRU/LRM level and present fault/failure data for display to the crew/maintainer/operator. All fault message and associated platform/vehicle conditions and status shall be maintained and stored on board the platform/vehicle for up to 90 days. Diagnostic systems shall automatically notify the crew and supporting maintenance system of status via the embedded prognostic and diagnostic system. In order to provide maximum coverage of critical failures, the embedded prognostics capability will supplement, as appropriate for the critical components and their failure modes, precursor-based prognostics with prognostics based on component life and stress-histories. *(Ref. FTTS MSV CDD 4.1.2.9.8)*

3.6.2.10.1 Prognostics. All FTTS platforms/modules will incorporate an embedded prognostics capability that will accurately predict pending critical system failures (any failures that cause system aborts IAW the reliability definition) to the appropriate LRU (LRU defined as any part or component replaceable by field maintenance personnel) that might occur in a 72 hour mission, early enough to allow corrective action before the unit begins the mission. Prognostics will provide coverage for 35% SA and 26% EFF at a 90% accuracy rate (threshold) 70% SA and 53% EFF at a 99% accuracy rate (objective). *(Ref. FTTS MSV CDD 4.1.2.9.8.1)*

3.6.2.10.2 Diagnostics.

Each FTTS MSV shall incorporate embedded diagnostics/BITE that unambiguously detects and isolates 80% (threshold)/ 99% (objective) of all essential and mission-critical functions. The diagnostics shall be able to fault isolate:

a. To one LRU 80% of the time (threshold)/99% of the time(objective).
b. To two or fewer LRUs 90% of the time (threshold)/ 95% (objective).
c. To three or fewer LRUs 99% of the time (threshold).

The background Built in Test Equipment (BITE) will store fault data for maintenance recall and will be available for use by maintenance personnel to verify repairs. Integrated diagnostics will support mean corrective maintenance time (MCMT) parameters.

All FTTS platforms/modules will incorporate an embedded diagnostics capability that will identify the system failures accurately to the appropriate LRU (LRU being defined as any card, module or component replaceable by field maintenance personnel), with notification first to the crew, then to the supporting maintenance personnel (through the logistics STAMIS). *(Ref. FTTS MSV CDD 4.1.2.9.8.2)*

3.6.2.10.3 Vehicle-to-Vehicle Umbilical Diagnostics.

A system umbilical (threshold), wireless system (objective)shall be available so that the each FTTS MSV shall be capable of receiving platform-to-platform interrogation and internal system access from supporting platforms, including power transfer, power sharing/charging, software recovery/updates, interactive electronic technical manuals (IETM) access (includes supporting updates), and performing all levels of prognostics and diagnostics. The vehicle-to-vehicle umbilical link shall allow for data transfer between vehicles that are 10 m apart. When the wireless system objective is attained it will add to and not replace the umbilical of the system.

Each FTTS MSV umbilical connection/receptacle shall allow easy vehicle hookup/connectivity to fixed-facility (motor pool, battle simulation center) auxiliary/commercial electric power and network (fixed tactical network) and enable maintenance, readiness reporting, and training to occur without running the vehicle engine or an external generator.

3.6.2.10.4 Common Tools. The FTTS will require no more than 10 common tools on the on board to perform all operator maintenance and 10 additional tools (carried by the CRT) to perform the remainder of the Field Level tasks. There will be no special tools or external TMDE required for field level maintenance. *(Ref. FTTS MSV CDD 4.1.2.9.12*)

3.6.2.10.5 Reserved.

3.6.2.10.6 Interactive Electronic Technical Manuals (IETM). Each FTTS MSV manned system must have an on-board, full IETM capability that includes operator and maintainer technical manuals (TMs) and Repair Parts and Special Tool Lists (RPSTL) for all onboard equipment, including GFE items (Threshold). The embedded virtual full task trainer will be fielded concurrently with the FTTS. All technical manuals must be Class 5, Interactive Electronic Technical Manuals, and include an embedded training to assist the mechanic/operator in performing maintenance tasks and diagnosis. *(Ref. FTTS MSV CDD 4.1.2.9.14*)

3.6.2.10.7 I.E.T.M Embedded Video Maintenance Support. The FTTS IETM software platform will allow the operator/maintainer to view actual video coverage on all Field Level Maintenance Tasks. The

operator/maintainer will use the IETM for standard maintenance fault isolation tasks, on-system video maintenance task demonstration, and on-system video instructional or refresher training. The IETM will have a multi option capability allowing the maintainer to access various tasks and use links to access video instructions/demonstrations for the task. The video function must allow start, stop, pause, rewind, fast-forward, and return to the maintenance window. This will allow the maintainer the option of viewing a maintenance task on video and returning to the maintenance procedures to begin the task. The video will be formatted using memory-reduced compression, and can be viewed through a high quality resolution screen. *(Ref. FTTS MSV CDD 4.1.2.9.15*)

3.6.3 Durability.

3.6.3.1 Drive Train Components. The vehicle shall not have less than a 60% probability of completing the first 32,000 kilometers (20,000 miles) of operation of a components lifecycle without overhaul, rebuild, or replacement of any of the following

1. Engine
2. Transmission
3. Transfer Case (if applicable)
4. Axles (if applicable)
5. Suspension
6. Drive motors (if applicable)
7. Propulsion Generator (if applicable)

3.6.3.2 Wear Out. Each FTTS MSV shall not have any assemblies/components that wear out or need replacement in less than 15,000 km (9,000 mi) or 2 years of operation.

3.6.4 Availability.

3.6.4.1 Operational Availability (Ao). Each FTTS MSV shall be fully operationally available 95% of the time (threshold)/99% (objective). Ao is the percentage of time during a mission pulse that a MSV (including all GFE/M and CFE/M) is operable and capable of performing its intended mission (no system aborts). Ao is calculated as the uptime divided by the sum of uptime and downtime during the mission pulse of the 3-day and/or 7-day mission lengths.

3.6.4.2 Service Life. The MSV shall have a design life that maintains the RAM requirements and is supportable for at least 25 years under the same environment and failure criteria. For 25-year life there will be

a. **XX% High Operational Tempo Missions.** 3-day high OPTEMPO.
b. **XX% Medium Operational Tempo Missions.** This equates to the 7-day mission.
c. **XX% Low Operational Tempo Missions.** Potentially defined as a standard peacetime CONUS training mission profile. Motor pool training using the network and commercial power will limit the number of miles driven (low mileage) while increasing the electronics/power systems "on" time for training.

d. **XX% Idle.** This time is defined as those days when the platform/vehicle is not training or on a mission and is positioned as idle in the motor pool ready for use/deployment. Examples are when the platform/vehicle is in the post-support cycle and is not doing any military training. Basically the vehicle sits in the motor pool unoccupied.

3.7 MANPOWER & PERSONNEL INTEGRATION (MANPRINT).

3.7.1 Human Factor Engineering. The vehicles shall be in conformance with MIL-STD-1472. Conformance shall be based on a 5th percentile female to 95th percentile male wearing NBC and cold weather protective clothing. All vehicle configurations shall ensure functionality, ease and safety of operation for all functions performed by operational and maintenance personnel based on 5th percentile female through 95th percentile male. The crew station for TOW weapon operation and ambulance litter loading shall accommodate the range between 95th through 5th percentile male soldier. The MSV shall be operational and maintainable by Military Operational Specialties while wearing the full range of army clothing, including arctic, and MOPP IV clothing. The MSV shall be operational and maintainable by Military Operational Specialties while wearing full combat gear (to include Load Bearing Equipment (LBE), personal body armor and protective mask), individual MOPP IV and arctic clothing. All operations for the MSV shall be capable of being performed by a crew of two soldiers (threshold) (objective - one soldier). System design and integration, to include operation of all equipment, shall accommodate operation and maintenance by a target audience of 5th percentile female through 95th percentile male. *(Ref MIL-STD-1472 for guidance and Ref. FTTS MSV CDD 4.1.2.1.2.5)*

3.7.2 Crew Compartment.

3.7.2.1 Cab. The FTTS MSV shall provide capability (objective) for a crew of up to 4 personnel (2 crews) to conduct 24-hour operations. Crew is defined by all prime mover and/or other systems' operators supported by the prime mover. *(Ref. FTTS MSV CDD 4.1.2.1.2)*

3.7.2.2 Crush Protection. The cab shall have cab crush protection that provides survivable space for the occupants as described in FMVSS 571.208 for occupant crash protection and roll over situations. Operator shall have visibility of the ground when negotiating terrain at maximum break-over angles. Cab shall be protected from terrain and natural obstacles while traveling cross-country. *(Ref. FTTS MSV CDD 4.1.2.7.5)*

3.7.2.3 Seating. Seats shall be individually adjustable fore and aft and to the occupant's height. The design shall provide leg, back and shoulder and head support. All seating shall be designed to safely accommodate soldiers outfitted with combat gear (i.e. Load Bearing Equipment (LBE) and flack vest, Mounted Warrior Soldier System (MWSS), etc.) and/or mission Oriented Protective Posture IV (MOPP IV) equipment to include headgear. *(Ref. FTTS MSV CDD 4.1.2.1.2.1, 4.1.2.1.2.2)*

3.7.2.4 Crew Restraint System. Each occupant seat shall have modern integrated safety restraint equipment, active/passive, that meets or exceeds Federal Motor Vehicle Safety Standards when operated over the

full vehicle mission profile, to include off-road use, at rated speeds. This system shall accommodate a soldier wearing full combat gear (to include LBE, personal body armor, and protective mask) and individual MOPP IV protective gear without interfering with vehicle or crew operation. *(Ref. FTTS MSV CDD 4.1.2.7.4)*

3.7.2.5 Windshield & Windows. Windshields and windows shall be configured to minimize solar glare. Visors or other means shall be used to preclude performance degradation due to glare from external sources such as sunlight or headlights. Full frontal and side glare or shade protection shall be provided to all vehicle occupants. However, windshields or other transparent areas through which high acuity vision is required shall not be impaired. Visors shall also be capable of telescoping to provide coverage across the entire width of the windshield and folding toward the vehicle's body sides to fully protect the occupants from side glare. Visors shall have a mechanical detent to prevent movement while in the stowed position. Windshield and windows must incorporate the requirements located in the classified annex G.

3.7.2.6 Windshield Wipers & Washers. The cab shall be equipped with multi-speed windshield wipers and windshield washing system. A 3-qt (2.8 l) washer reservoir compatible with cleaner and appropriate additives for the climatic conditions for destination shall be furnished. Windshield wipers and washers shall conform to FMVSS 571.104 and SAE J198.

3.7.2.7 Vehicle Cab Interior. The vehicle cab interior and upholstery color shall be black, dark green, or dark brown. If the vehicle exterior is tan, then the interior shall be either black or tan. Where applicable, the cab undercarriage shall be insulated to reduce engine noise and the transmission. Interior foam shall be a minimum of two inches thick (objective). A first aid kit and a #10 BC fire extinguisher IAW FMCSR 393.95 shall be mounted within the cab interior and shall be detachable to allow removal from the cab. The upholstery (seat cover leather/vinyl/canvas/mesh) shall be repairable/replaceable by the operator.

3.7.2.8 Cab Floor Drains. The cab floor shall be provided with floor drains to permit draining of freestanding water on the cab floor. Removable plugs shall be provided for sealing of each hole. The plugs shall be captively restrained to the cab floor with a tether. The drainage system shall be NBC compatible.

3.7.2.9 Chemical Protective Equipment Storage. Space shall be provided inside the cab for the following: NBC garment suit, two per crewmember; NBC mask, one per crewmember; NBC gloves, two pair per crewmember; NBC overboots, one pair per crewmember; NBC hood, one per crewmember. The specified protective clothing shall be restrained by a quick disconnect type device to prevent unseating when traveling over rough terrain and when only a portion of the garments are being utilized.

3.7.2.10 M4/M16 Rifle Mounting. This kit will provide the necessary hardware for the mounting of two government-furnished rifle mounting kits inside the cab, one on each door. The kits shall consist of the items found on drawing 5705590. Holes will be provided for attachment of all items to the doors and will be filled with threaded fasteners.

3.7.2.11 Cab Temperature Control. The FTTS MSV environmental control system shall consider the NBC requirements in its design.

3.7.2.12 Rear View Mirrors. Mirrors conforming to A-A-52432 shall be provided on the left and right hand sides, be capable of folding toward the body sides in at least one direction, and prevent vibration during operations.

3.7.2.13 Stowage. Stowage space with latching device to utilize a standard military padlock shall be provided to accommodate Basic Issue Items (BII), publications (operator, hand receipt and warranty) and operator's Common Table of Allowances (CTA) 50-900 personal clothing and equipment. All stowage boxes shall contain drain holes. Publications shall be stowed inside of the cab above the fording line. Provisions shall be included that prevent contents of BII from resting on the bottom of the box without obstruction of the drain holes.

3.7.2.14 Displays. Crew compartment integration and assignment of functions to displays shall consider population characteristics, crew task requirements, crew workload through the mission, functional relationships between controls and displays, crew compartment physical constraints, operating environment, assessments of available display technologies, and crew physical limitations.

The loss of a single primary display device shall not prevent mission completion.

The integrated crew system interface shall consist of an optimal display configuration that can be appropriately configured for any mission phase, shall accommodate the display of all critical information, shall facilitate the efficient access to secondary information, and shall facilitate collaboration.

The crew station shall include the controls and displays that enable the crew to record display images and training video.

3.7.2.14.1 Display Visibility & Audibility. Displays shall be located and designed to be visible and legible from the crew design eye position under all expected vibration and illumination conditions.

Visual displays shall be designed to minimize glare and reflections and shall not be obstructed by controls, limbs, or equipment.

Displays, which have a corresponding auditory function, shall be designed so that their message content is audible and easily understood under all operational and auditory environmental conditions.

3.7.2.14.2 Visual Display Performance. Display performance parameters (e.g., luminance, resolution, color generation, contrast) shall be optimized for the human visual system performance characteristics, and for the type, quantity, and precision of information being displayed.

Crew control of display parameters (e.g., brightness, contrast, and color) shall be provided.

Visual displays shall not exhibit or produce distracting visual effects, artifacts, or anomalies (e.g., flicker, jitter, or noise) that will induce fatigue or degrade human performance.

Visual displays shall be easily readable throughout the entire expected range of ambient illumination with special consideration for any anticipated extreme viewing conditions that may occur within that range.

Displays shall be night-vision imaging system compatible.

3.7.2.14.3 Controls. Crew compartment integration and assignment of functions to controls shall consider population characteristics, crew task requirements, crew workload through the mission, functional relationships between controls and displays, crew compartment physical constraints, operating environment, assessments of available control technologies, and crew physical limitations.

The crew compartment system shall be capable of arming and disarming self-defense weapons independent of weapon release consent.

The ingress/egress doors shall latch securely in the closed position from the inside.

Provision shall be made to prevent inadvertent actuation of internal door/control handles while entering or leaving the platform, performing routine mobility duties, or performing maintenance on the platform.

3.7.2.15 Control Design & Mechanization. Controls shall be designed and coded to enable the crew to effectively accomplish all required control tasks, maximize head-up operation, and optimize sequential operation.

Controls shall not be susceptible to inadvertent actuation, particularly those critical controls that, if inadvertently actuated, may result in damage to equipment, injury to personnel, or degradation of system functions.

Methods used to protect from inadvertent actuation shall not preclude control operation within the time required.

Controls shall be mechanized to provide appropriate feedback (intrinsic/extrinsic) to indicate whether the control is properly actuated.

Controls shall accommodate the crew's anthropometric dimensions and strength limitations, taking into consideration all environmental conditions and any required mission equipment (armor, biological-chemical protective gear, NVGs, laser eye protection, gloves, etc).

3.7.2.16 Control/Display Integration. The relationship of a control to its corresponding display shall be apparent and unambiguous.

Control and display complexity and precision shall not exceed the capability of the operator or exceed the operator's motor, cognitive, and perceptual capabilities under the dynamic mission conditions and environment.

Displays shall clearly and unambiguously direct and guide the appropriate control response.

3.7.2.17 Position Relationships. Controls shall be positioned so that neither the control nor the hand normally used for setting the control will obscure the display.

Functionally related controls and displays shall be located and sequenced to provide for left-to-right (preferred) or top-to-bottom order of use (or both) and shall be in proximity to one another and arranged in functional groups (e.g., power, status, and test).

In instances when an operator must use a large number of controls and displays, their locations and arrangement shall be designed to aid in determining which controls are used with which displays, which equipment component each control affects, and which equipment component each display describes. The more important groups and functional groups that are used most frequently used should be in the areas that are most easily accessed.

Emergency displays and controls shall be located where they can be seen and reached with minimum delay.

A visual display that must be monitored concurrently with the manipulation of a related control shall be located so that the operator is not required to observe the display from an extreme visual angle, thus introducing the possibility of parallax error.

The arrangement of functionally similar or identical primary controls shall be consistent from panel to panel throughout the system.

3.7.2.18 Movement Relationships. The response of a display to control movements shall be consistent, predictable, and compatible with the operator's expectations (e.g., direction of control movement shall be consistent with related movement of an associated display, equipment component, or platform).

3.8 MATERIAL HANDLING EQUIPMENT (MHE).

3.8.1 Intelligent Load Handling Systems (ILHS). The Intelligent Load Handling System (ILHS) must operate as a dual function of the modular platform self load arm. ILHS shall have the agility and range of motion to pick up and transport pallets that are stacked unevenly on unimproved terrain or positioned in or on itself and various modes of transport. The ILHS will load modular containers and platforms on the FTTS as well as configure modular packaged loads on platforms. *(Ref. FTTS MSV CDD A-5.7)*

3.8.1.1 Vehicle Integration. The ILHS shall be integrated into the FTTS MSV and shall not degrade the responsiveness, crew safety, deployability, transportability, agility, reliability, sustainability, operation, and survivability of the vehicle.

3.8.1.2 Reserved.

3.8.1.3 Operation. All ILHS functions shall be capable of one-man operation. The ILHS shall be operable by military personnel of the same skill level required for tactical truck operation, such as skill level 1 Career Management Field (CMF) 12, CMF 33, CMF 51, CMF 62, or CMF 63 operator. The ILHS operator station and operator control unit shall accommodate the range between a 5th percentile and 95th percentile Soldier.

3.8.2 ILHS Systems Components. The ILHS system may be comprised of two subsystems; a manipulator system for individual palletized cargo handling and a handling system for self-loading/unloading cargo platforms, containers, etc. For clarity, this specification will address the requirements of each function separately; however, this specification does not preclude the development of a single manipulation system capable of performing both functions.

3.8.2.1 Manipulator. The manipulator function of the ILHS shall be used to load and unload individual palletized cargo from/to the vehicle, other vehicles, cargo platforms, the ground, stacked on other cargo, or other forms of mode transport (i.e. railcars). The IHLS shall provide control of the end effector (e.g. fork tines) in six degrees of freedom.

3.8.2.1.1 Cartesian Control. The ILHS manipulator system will use computer control to enable Cartesian and joint controlled teleoperation and semi-autonomous control for individual palletized load manipulation.

3.8.2.1.2 Teleoperation. A baseline minimum for operation of the system dictates that the operator has the ability to teleoperate the system in the Cartesian coordinate frames of the truck (Global), the end-effector (Hand), and in joint space coordinates. The mathematical algorithms must not cause erratic motion, or loss of control, in any position, including singular positions. If the system is redundant, in that it has more than six degrees of freedom, manipulation of these redundant degrees of freedom must be controllable by the operator while maintaining the tool in its current position and orientation.

3.8.2.1.3 Semi-Autonomous Transport Path. This feature is a preprogrammed/programmable path around the truck that permits the operator to simply command speed and direction without concern of the orientation of the payload or avoidance of known obstacles in the workspace, resulting in maximum speed and efficiency. A ‘Transport Path’ strategy for rapid positioning of the crane around its perimeter eliminates the need for an operator to teleoperate the system in gross positioning tasks. The operator simply commands the crane to attach to a preprogrammed path and the system executes the move automatically. The operator is only required to command direction and velocity along the path. This feature requires that the ILHS system provides teach, record, and execution of programmed paths, as well as the ability to locate the closest position on the path from an arbitrary position. A programming capability can also be used for recording positions and orientations for repetitive operations, storage positions on the truck, and the stowage configuration of the manipulator for transport.

3.8.2.1.4 Kinematic Configuration. The contractor will determine the number of axes and the manipulator's kinematic configuration necessary to comply with the requirement for 6 DOF manipulation.
The manipulator component shall be operable while the FTTS MSV is carrying a secured, fully laden cargo platform on board.

3.8.2.1.5 Payload Capacity and Reach. The manipulator shall have a payload capacity of ≥ 6,000 pounds (threshold), 10,000 pounds (objective) at a ≥ 17ft radius (threshold), 23 ft radius (objective).

3.8.2.1.6 Reserved.

3.8.2.1.7 Velocity. The manipulator will have a linear tool velocity of ≥ 24″/sec at maximum reach with no payload. The manipulator will have a linear tool velocity of ≥ 12″/sec at 17′ reach with a 6000 lb. payload.

3.8.2.1.8 Minimum Step Size. The manipulator will have a positioning resolution of <.125 inches. To provide reasonable response of the system while acquiring and releasing payloads, the system must respond to a 0.125 inch or less Cartesian command increment throughout the workspace envelope.

3.8.2.1.9 Repeatability. To provide reasonable control during teleoperation and the anticipated integration of future automatic controls, the system must be capable of moving to any position within the workspace within a standard deviation of ≤ 0.25 inches or better, after the system has reached thermal equilibrium.

3.8.2.1.10 Overshoot. The system must be overdamped throughout its work envelope and payload range. No overshoot is acceptable to a step input.

3.8.2.1.11 Position Feedback. Each manipulator axis will incorporate an absolute position feedback device of suitable resolution to meet the aforementioned positioning specifications.

3.8.2.1.12 Stowage. The manipulator, end-effector, and ancillary accessories will stow compactly to accommodate all FTTS MSV Transportability requirements (air, sea, ground, rail) and stow securely to enable safe, off road transport.

3.8.2.1.13 Safety. The ILHS manipulator system shall conform to ASME/ANSI B30.22-2000 standard and EN12999, the European Standard for cranes and loader cranes, via British Standards Institution (BSI) and European Committee for Standardization (CEN) technical committees.
The manipulator system shall incorporate valves to hold each axis in position in the event of control, hydraulic supply, or electrical failure. Normal leakage cannot permit loss of the payload and must lower the payload in a stable manner at no greater than 2 inches per hour at full payload and maximum reach. In the event of a failure in the manipulator system, a back up means by which to stow the manipulator is required.

3.8.2.1.14 End-Effector. The manipulator will be equipped with an end effector suitable for lifting the palletized cargo. The end effector must be able to access these payloads when they are mounted on cargo

platforms or in dense storage inventory, that is, in tightly grouped arrangements or stacked. Due to the range of legacy pallet types and sizes that must be handled, a powered, adjustable mechanism will be required. The actuator(s) for this mechanism can be either electrically or hydraulically driven. The actuator(s) shall be equipped with absolute position feedback in order to support future automation developments. The end-effector will have a positioning resolution of <.125 inches. To provide reasonable response of the system while acquiring and releasing payloads, the system must respond to a 0.125 inch or less command increment throughout the end-effector's range of motion. The end-effector mechanism will contain minimal (T) or no (O) backlash.

3.8.2.2 Platform Handling System. The platform handling function of the ILHS will comply with all FTTS MSV requirements. The encompassing requirement for the platform handling system is that it shall meet or exceed the current LHS interface capabilities and cycle time Shall not exceed 3 minutes (threshold), 1 minute or less (objective). Cycle time is defined as time the lift arm is engaged to the time the load is in place and secured.

3.8.2.2.1 Payload. The MSV and its companion trailer shall each carry 11 ST cargo payload on a flatrack, which weighs no more than 2 ST (threshold), 1 ST or less (objective). Payload consists of cargo on a flatrack or CROP, sustainment modules, shelters / modular/configured loads and/or other containers / tank racks / quadcons / tricons or LHS compatible devices (i.e. with integrated bail bar or other LHS compatible lift point) (herein referred to as LHS payloads).

3.8.2.2.2 Operation.

3.8.2.2.2.1 Reserved.

3.8.2.2.2.2 Self Load/Off Load. The FTTS MSV and its companion trailer shall directly load/off load cargo laden or empty pallets to/from aircraft and to/from the TSV without additional interfaces and/or material handling equipment (including other services' equipment). The FTTS-MSV shall move containers up to the allowable handling capacity of the lift system within the TSV cargo hold.

3.8.2.2.2.3 Load Conditions. The vehicle-installed robotic lift arm must be capable of loading/unloading a 13-ton load under the following conditions:

3.8.2.2.2.3.1 Vertical Condition. From/down to payload base one foot below ground level.

3.8.2.2.2.3.2 Lateral & Longitudinal Condition. From/onto an uneven ground slope of five degree (threshold), ten degrees (objective), from the prime mover's lateral and horizontal axes.

3.8.2.2.2.3.3 Approach Angle. Attach to a payload from an approach angle of 10 degrees (threshold), 20 degrees (objective), from the vehicle centerline and load and secure the payload to the prime mover. 10 degrees (threshold), 20 degrees (objective)

3.8.2.2.3 Overload. A safety allowance that meets industry standards for overload will be incorporated into the FTTS MSV hydraulic lifting system.

3.8.2.2.4 International Standards Organization (ISO) Locks. The platform handling system shall accommodate ISO locking device-equipped cargo containers (objective).

3.8.2.2.5 Modular Intermodal Platform (MIP) Interface. The ILHS must interface to the MIP, which is currently under development.

3.8.2.2.6 Redundancy & Manual Backup. With the computer control mandate, a level of redundancy and/or a manual back up control capability is required. Subsystems must in place that enable the continued use or at a minimum the stowage of the equipment in the event of a failure. Provisions shall be incorporated to enable the operator to complete the material handling operation and properly stow the system for repair later. For example, if a computer or position feedback failure occurs during material handling operations, the ILHS system shall incorporate a redundant system to replace the defective items, an open loop control to permit teleoperation without joint feedback on that axis (or axes), or a back up system that allows the operator to control each axis manually similar to conventional crane operation. If the cargo platform system fails, a means by which the operator can move the system back into a stowed position on the vehicle is required. In summary, the ILHS must be at a minimum one fault tolerant (T), two fault tolerant (O), excluding battle damage.

3.8.2.2.7 Vehicle Alignment System. A vehicle alignment system must enable the FTTS MSV operator to safely and effectively align with modular platforms, containers, Air Force aircraft, trailers, or other trucks for loading, unloading, or trans-loading.

3.8.3 Stabilization System. The manipulator system must operate on a stable base at all times. The payload, reach, and dynamic loading (loads introduced into the system due to acceleration and deceleration forces) requirements of the ILHS require a stabilization system be incorporated into the FTTS MSV ILHS design. The stabilization system shall expand the footprint of the vehicle platform, so that the sum of the operational moments are substantially less than the moments required to overturn the vehicle. The stabilization system shall not restrict the operational range of the manipulator’s workspace while manipulating the system’s full payload at full extension. Outriggers or articulated support structures can be designed integral with the vehicle platform or the manipulator system.

3.8.3.1 Ground Inclination Limits. While using the manipulator for cargo handling, the stabilization system shall provide a secure base throughout the manipulator payload and reach range on a ground slope of five degrees (threshold), with ten degrees (objective), from the prime mover's lateral and horizontal axes. The operator will be responsible for the evaluation of soil conditions to ensure adequate support of the ground contact points of the system.

3.8.3.2 Manipulator Inhibit & Backup. The control system will inhibit manipulator operation without verification of deployment of the support

structure. Once deployed, the stabilization system shall be locked to prevent collapse due to power loss or hydraulic supply failure. In the event of a failure in the stabilization system, a back up means by which to retract the support structure is required.

3.8.4 Electrical System. The ILHS manipulator, end-effector and stabilization system will operate on the electrical system provided by the FTTS MSV vehicle platform.

3.8.5 Hydraulic System. The hydraulic system to support the ILHS will be powered by the FTTS MSV vehicle platform.

3.8.6 Operator Interface. The operator interface for the manipulator will consist of an operator control station within the cab and a hand held control operator pendant for use outside the cab. The ILHS operator interface shall be consistant with the requirements stated in paragraphs 3.5 and 3.7.

3.8.6.1 Operator Control Station. The operator control station within the cab shall consist of a display and an operator input device(s), such as keyboard, mouse, touchscreen or voice input. The interface will enable the operator to perform all operations of the system including teleoperation, teach, program, and execution modes of operation. In addition, this interface will enable the operator to monitor the diagnostics of the ILHS system, access operation and training documentation, as well as interface with C2 and existing inventory and other military databases relevant to material handling operations.

3.8.6.2 Operator Control Pendant. The ILHS system shall include an operator control pendant to enable an operator to control all ILHS functions outside of the cab. These operations include teleoperation, transport path, autonomous routines, teach, program and execution modes of operation. The operator control pendant shall be operable as a tethered (threshold) or wireless (objective) device.

The wireless transceiver shall have a minimum range of operation of up to 30 feet from the vehicle platform. The wireless remote control pendant shall incorporate batteries that ensure 8-hour continuous operation without recharge. An onboard recharge station shall be incorporated into the system, and the ILHS shall include two additional battery modules for replacement. Wireless transmissions shall not interfere with other C4I equipment.

3.9 FTTS MSV COMPANION TRAILER (CT).

3.9.1 General. The FTTS MSV Companion Trailer (CT) will support the MSV in its role of a distribution platform. The FTTS MSV CT will be employed throughout the UA/UE. The MSV CT will be highly mobile, efficient, extremely reliable, and fully compatible with the MSV. The FTTS MSV CT will support the MSV’s capability of keeping pace with the increasingly mobile and widely dispersed maneuver forces dictated by Future Army Concepts. The FTTS MSV CT must be capable of operating over increased distances with increased payloads. The FTTS MSV CT will rapidly distribute all classes of supply.

3.9.1.1. Commonality. The FTTS MSV CT shall utilize common components compatible to the FTTS MSV to the maximum extent as possible.

3.9.2 Mission Profile. The FTTS MSV CT shall operate over the same OMS-MP of the Maneuver Sustainment Vehicle unless otherwise noted below. *(Ref para 3.1 and FTTS MSV CDD annex D)*

3.9.3 Trailer Payloads. The FTTS MSV CT shall be capable of transport of equipment, NATO flatracks, varied mission module (e.g., bulk fuel and water, ammunition, and cargo transport), 463L pallets and receiving and transporting standardized containers up to twenty feet. The FTTS MSV Companion Trailer shall carry 11 ST cargo payload on a flatrack, which weighs no more than 2 ST (threshold), 1 ST or less (objective). Payload consists of cargo on a flatrack or CROP, sustainment modules, shelters / modular/configured loads and/or other containers / tank racks / quadcons / tricons or LHS compatible devices (i.e. with integrated bail bar or other LHS compatible lift point) (herein referred to as LHS payloads). The FTTS MSV CT shall receive any load carried by the MSV utilizing only the MSV either connected to or not connected to the MSV (threshold) or shall self-load/off-load any load carried by the MSV (objective) without additional interface, kits, or MHE. (*Ref para 3.2.6.1 & Ref. FTTS MSV CDD 1.5.2)*

3.9.4 Dimensions. Dimensions shall meet the requirements of the FTTS MSV except as noted below

3.9.4.1 Height. MSV CT must be capable of negotiating a 4-meter underpass while transporting an empty ISO 668, Type 1C freight container mounted on a flatrack without preparation. While being transported on a C-130 aircraft, the height of the CT, while carrying a CROP, must not exceed 102 in (threshold/objective).

3.9.5 PERFORMANCE CHARACTERISTICS. The MSV CT performance characteristics shall meet those of the MSV with additions noted below. (*Ref. para 3.2 & FTTS MSV CDD 4.1.2.4*)

3.9.5.1 Mobility. The FTTS MSV CT shall meet the FTTS MSV mission profile. The FTTS MSV Companion Trailer while empty or fully loaded shall cause no less than 20% mobility degradation to the prime mover (threshold) no decrease in the mobility characteristics of the prime mover (objective). *(Ref. FTTS MSV CDD Annex D,* Table II, section 3.2.1.6*)*

3.9.5.1.1 Tracking. The FTTS MSV CT shall follow the track behind the prime mover. *(Ref. FTTS MSV CDD Annex D-3)*

3.9.5.1.2 Autonomous Operation (Objective). The MSV CT shall be self-mobile and controlled independent of the MSV, although this does not preclude from being controlled from onboard the MSV, for autonomous missions.

3.9.5.1.2.1 Range. When used for autonomous missions, if a combustion engine is used, the propulsion system shall use the standard Army battlefield fuel and shall have the range of 46 mi (75 km) threshold, 93 mi (150 km) objective on a single tank of fuel while carrying a full load over the OMS-MP and where the fuel tank does not exceed the size

of the HMMWV fuel tank (threshold) or one-half that of the HMMWV fuel tank (objective).

3.9.5.1.3 Braking. The MSV CT shall meet the braking requirements of the MSV unless otherwise noted below. *(Ref para 3.2.1.7 & FTTS MSV CDD Annex D-5)*

3.9.5.1.3.1 Separated Brake System. The FTTS MSV CT shall have a braking system that activates when separated from the prime mover and shall hold the trailer on a 30 percent longitudinal Grade (16.7 degree slope) (in either direction) (threshold) (40 percent longitudinal Grade(21.8 degree slope) (objective)) when uncoupled. *(Ref. FTTS MSV CDD Annex D-5.1)* The operator shall disengage this capability within 30 seconds (threshold), 15 seconds (objective) in the event the trailer must be moved when uncoupled from the prime mover. *(Ref. FTTS MSV CDD Annex D-5.2)*

3.9.5.1.3.2 Military & FMVSS Compliance. The FTTS MSV CT shall meet current military and federal motor vehicle safety standards. *(Ref. FTTS MSV CDD Annex D-5.3)*

3.9.5.1.4 Coupling/Uncoupling. The FTTS MSV CT shall be capable of being coupled/uncoupled by one soldier and free standing on both hard and soft surfaces when fully loaded. *(Ref. para 3.2.4 & FTTS MSV CDD Annex D-5.5)*

3.9.5.1.5 Tires/Wheels. The FTTS MSV CT shall meet the tire requirements for the MSV and have lug nuts, tires and wheels fully compatible with the FTTS MSV. *(Ref para 3.2.1.13 & FTTS CDD Annex D-7)*

3.9.5.2 Standard Obstacles. The FTTS MSV CT shall meet the standard obstacle requirements as listed in paragraph *3.2.3.*

3.9.5.3 Expediency/Emergency Towing. The FTTS MSV CT shall capable of being safely towed by current medium and heavy fleet trucks for emergency movement. *(Ref. Ref para 3.2.4 & FTTS MSV CDD Annex D-5.6)*

3.9.5.3.1 Backing Truck-Trailer Combination. The FTTS MSV CT shall be capable of being backed safely from any normal position (such as when in a turn but not from full jackknife) without damage to truck, trailer, or payload, and without necessity for operator dismounting or other preparation. *(Ref paras 3.2.4 & FTTS CDD Annex D-6)*

3.9.5.4 Trailer Transloading Capability. The MSV CT shall be capable of transloading 463L Pallet, flatrack, tankrack, other payloads, and containers to/from the MSV, to another MSV, another MSV CT, an aircraft (C-130, C-17, or C-5), a flatdeck railcar, a semi-trailer (M871 or M872), or the ground (+/- 6 inches and level ground (threshold); +/- 12 inches and +/- 5 degree (objective)) without disengaging from the prime mover (objective).

3.9.5.5 FCS Interface. The MSV CT shall have capability to transload a FCS sustainment module directly to/from the ground (+/- 6 inches and level ground (threshold); +/- 12 inches and +/- 5 degree (objective)) without disengaging from the prime mover (objective), flatrack, 4630L pallet, itself, another MSV CT, or an MSV to/from a FCS ground system or between FCS ground systems (objective).

3.9.6. Reserved.

3.9.7. Reserved.

3.9.8. DEPLOYABILTIY & TRANSPORTABILITY. The MSV CT shall meet the deployability and transportability requirements of the MSV. *(Ref. para 3.4 & FTTS MSV CDD 4.1.2.3)*

3.9.8.1 Roll-On/Roll-Off Capability (Objective). The MSV CT shall have semi-autonomous Roll-On/Roll-Off capability, aboard any means of conveyance, and have a self-deployable range of 1000m (threshold), 2000m (objective) operable by a single operator (i.e. 1 load master) only utilizing onboard systems and BII. The means by which to power the MSV CT shall be consistent with closed confined quarters such as a ship deck or cargo well and shall not cause interference with other C4ISR or electronic systems.

3.9.9 Trailer Command, Control, Communications, Computers & Intelligence (C4I). The C4I system onboard the MSV CT shall be interoperable with the C4I system aboard the MSV and compatible with FCS C4ISR systems for data reporting/recording and other C4I functions.

3.9.9.1 Sustainment Data & Reporting. The FTTS MSV CT shall utilize the FTTS MSV to automatically collect maintenance and cargo (payload) sustainment data (threshold) or have the capability to self-report sustainment data upon demand (objective). (*Ref. para 3.5 & FTTS MSV CDD 4.1.2.9.19.1; 3.5.1.4 &.5; 3.5.13; 3.5.13.1 & FTTS MSV CDD Annex D)*

3.9.9.2 Diagnostics/Prognostics. The FTTS MSV CT shall meet the diagnostics/prognostics requirements/capabilities of the MSV (threshold). *(Ref. Para 3.5, 3.6.2.10 and FTTS MSV CDD annex D)*

3.9.9.2.1 Payload Data. FTTS MSV CT shall incorporate sensors that automatically collect and report (threshold) and transmit(objective) payload data (e.g., weight, center of gravity, load-sensing data, etc.) *(Ref. FTTS MSV CDD 4.1.2.5.1)*

3.9.9.2.2 Anti-Rollover System. The FTTS MSV CT shall incorporate an Anti-Rollover / Warning System. This system will warn the driver of conditions which may result in the trailer rolling-over (threshold), and automatically apply mechanisms to prevent a roll-over (objective).

3.9.9.3 Identifying Friend or Foe (IFF) Devices. The MSV CT shall meet the IFF Devices requirements of the MSV. *(Ref para 3.5.14)*

3.9.9.4 Unique Identification (UID). The FTTS MSV CT shall incorporate Unique Identification markings. (*Ref SECDEF policy memo dated 29 June 2003, subject: Policy for Unique Identification (UID) of Tangible Items – New Equipment, Major Modifications, and Reprocurements for Equipment and Spares).*

3.9.10 Power Generation. The FTTS MSV CT shall provide exportable power in accordance with paragraph 3.2.1.21.5 (33 kW minimum - objective).

3.9.11 Reliability, Availability, Maintainability & Durability (RAM&D). The CT shall meet the RAM&D requirements of the MSV and shall not inhibit the RAM&D of the prime mover system when towed. *(Ref para 3.6 & FTTS MSV CDD 4.1.2.8)*

3.9.12 Manpower & Personnel Integration (MANPRINT). The FTTS MSV CT shall be in conformance with the Human Factors Engineering and Safety requirements and standards applied to the Maneuver Sustainment Vehicle. *(Ref. para 3.7)*

3.9.13 Ride Quality. The FTTS MSV CT shall meet the ride quality requirements for the MSV. (Ref. paragraph 3.2.1.7)

3.10 General.

3.10.1 Fuels & Lubricants.

3.10.1.1 Fuels & Lubricants. The MSV shall be operable with applicable standard military fuels (JP-8 and diesel, if the design incorporates a fuel burning engine), lubricants and fluids as required by the climatic operating requirements without component degradation and adverse affect on the vehicle performance or warranty provisions. All initial fills shall be of standard military fuels, lubricants and fluids including those called out in A-A-52557, MIL-PRF-46167, MIL-PRF-2105, MIL-PRF-2104, MIL-PRF-10924, MIL-DTL-83133, and A-A-52624. If liquid cooled, the engine shall be serviced with a solution of ethylene glycol conforming to A-A-52624 and water in equal parts by volume. *(Ref. FTTS MSV CDD 4.1.2.9.5)*

3.10.1.2 Vehicle Lubrication. A single fluid shall be used for all lubrication and hydraulic applications. All fluid analysis, if required, shall be performed on system with the result provided to the interface of the maintenance system. The manufacturer shall make maximum use of single point/central lubrication system to lubricate multiple components from one location where commercially available. Where possible use of permanently lubricated components such as universal joints and unitized wheel hubs shall be utilized. Grease fittings shall only be used when maintenance free components are not available. Grease lubrication fittings shall conform to SAE J534. Pressure relief shall be provided in all cases when lubricating pressure may damage grease seals or other parts. Fluid changes directed though on-board fluid analysis are not considered a scheduled maintenance event; however, the platform will have a 95% probability that it can complete 7,000 miles (or equivalent hours) between fluid replacement. *(Ref. FTTS MSV CDD 4.1.2.9.4)*

3.10.1.3 Self Refueling. Each FTTS MSV must have an internally operated, self-refueling capability that allows the platform to refuel itself or discharge its internally stored fuel into another MSV or fuel storage receptacle at a rate of 15 GPMs using automated/robotic means. Additionally, each FCS platform must be capable of open port, gravity refuel. *(Ref. FTTS MSV CDD 4.1.2.9.6)*

3.10.1.4 Fuel Access Connection. The FTTS MSV shall have a fuel access connection to allow access to FTTS MSV fuel for power units. *(Ref. FTTS MSV CDD 4.1.2.5.7)*

3.10.2 Materials, Painting, & Corrosion.

3.10.2.1 Material. Unless specified otherwise in the contract, all materials provided as part of the Production Variants shall be new and

unused. Recycled material is acceptable when processed to make new material. The recycled material shall consist of at least 50% virgin material.

3.10.2.2 Camouflage. The FTTS MSV shall be painted in NATO three-color camouflage or desert tan using Chemical Agent Resistant Coating (CARC) or a DA G4 approved substitute.

3.10.2.3 Corrosion Resistance. Corrosion resistance shall be sufficient to ensure serviceability for the entire expected 25 year EUL (Economic Useful Life) of the vehicle without rebuild. *(Ref. FTTS MSV CDD 4.1.2.8.1.3)*

3.10.3 Potable Water.

3.10.3.1 Water Generation. The FTTS-Variants shall incorporate an embedded potable water generation and storage capability that allows the FTTS-Variants and assigned operator/crew to operate without external water re-supply. *(Ref. FTTS MSV CDD 4.1.2.5.11.1)*

3.10.3.2 Water Dispenser. The FTTS-Variants shall be capable of separately dispensing cold (ambient temperature) and hot (115-120 Degrees F) potable water from the embedded potable water generation system in order to provide drinking water and hydration of compressed rations. *(Ref. FTTS MSV CDD 4.1.2.5.11.2)*

3.10.3.3 Water Cross-Leveling. The FTTS Variants- shall incorporate an internally operated cross-leveling capability to re-distribute water between other FTTS MSV/FCS systems and crews. The FTTS-Variants shall be capable of both dispensing/receiving water during cross-leveling operations and open port gravity fill. *(Ref. FTTS MSV CDD 4.1.2.5.11.3)*

3.10.3.4 Captured Water from Environmental Control System. All condensation from environmental control system shall be captured and recycled. *(Ref. FTTS MSV CDD 4.1.2.5.11.4)*

3.10.4 Commerciality/Commonality, Components, Parts, & Accessories. All power train components shall be certified by the contractor as being compatible with and properly matched with all related or affected components assembled to meet the specifications stated herein. . The components of the FTTS MSV variants shall be 70% common (threshold), 90% or greater (objective) and will achieve the maximum possible commonality with the FCS platforms.

3.10.5 Vehicle Security. The FTTS MSV shall have a means to provide vehicle security (e.g., door locks, locking hatches and fuel tanks, etc.). The security system shall provide the capability to lock the entry points from inside the vehicle without inhibiting a quick exit from the vehicle. When the FTTS MSV is locked from the outside, it shall be in compliance with requirements for securing communications equipment when vehicle is unattended, but shall not inhibit quick exit from the inside. *(Ref. FTTS MSV CDD 4.1.2.1.2.4)*

3.10.6 Controls & Control Cables. Identifying symbols for controls and operating mechanisms shall be in accordance with FMVSS 571.101 and 571.102. All control cables shall be of the low friction type protected at both ends with adequate seals to prevent entry of moisture and

contamination into the support tube and to provide a bearing surface for smooth motion of the end rod.

3.10.7 Rear Reflective Signature. Exterior safety markings meeting the intent of the requirements of FMVSS 571.108, section 5.7, shall be applied on the rear of the MSV. Marking system shall be designed for ease of removal/reattachment and storage requirements for repeated use.

3.10.8 Collision Warning System. A collision warning system shall be installed on the vehicle that shall provide the driver a visual/audible indication when objects are too close to the vehicle. The central processing unit shall be able to compute closing speeds from 0.25 to 100 mph (minimum). The front antenna transmitter/receiver shall have a range of 1 to 350 feet (minimum). Side blind spot and indicator shall be provided to right hand side for blind spot detection. Driver interface unit shall warn driver both visually with LED indicators and audibly with tones for approaching, potential hazardous situations. Components shall be constructed for external mounting and operate in the environmental conditions of the vehicle. Vehicle operator shall be able to turn the entire system on and off. Blackout controls for the Collision Warning System shall permit all of the indicator lights to be shut off during blackout situations. The audible alarm shall be controlled by the volume knob on the dash display unit. Collision warning system displays and controls shall include requirements listed in paragraphs 3.5 and 3.7.

3.10.9 Kits. The vehicle shall be capable of accepting all kits as specified herein. Each kit, shall not take longer than 4 man-hours to initially install at Field Level maintenance and subsequent installation shall be completed by the operator within .5 hours. Holes shall be provided for the attachment of all kits and shall be filled with threaded fasteners or plugs. When specified the following kits shall be provided.

3.10.9.1 Engine Arctic Kit. The contractor shall provide an engine arctic kit that allows the vehicle to be started within 45 minutes (threshold), 20 minutes or less (objective) and operated within 15 minutes after starting, at temperatures down to -50 degrees F (-46 degrees C).

3.10.10 Workmanship. Workmanship shall be of such a quality so as to assure that the vehicle and its components are free of defects that compromise, limit or reduce the capability of the vehicle system in the performance of its intended use. Bolted and riveted construction shall be secure IAW its intended use. All fuels, lubricants, and hydraulic fluids shall be provided clean and filtered IAW their intended use.

3.10.11 Servicing & Adjusting. Prior to acceptance of the vehicles by the Government, contractor shall service and adjust each vehicle including at least the following: Focusing of lights; adjustment of engine and transmission; adjustment of electrical and brake systems; burnishing of the brakes sufficient for the vehicle to meet the grade holding requirements of this performance specification; alignment of steering and front wheels; inflation of all tires; complete lubrication of chassis, engine, running gear, and mounted equipment with grades of lubricants required for the ambient air temperature at the delivery

point; filling of windshield washer reservoir with water and appropriate additives rated to -25° F(-31° C); check of wheel lug nut torque; check of the continuity of the electrical system; and filling and charging of batteries. A minimum of 1/4 fill of fuel shall be provided in each vehicle's fuel tank.

3.10.12 Interoperability, Standardization & Compatibility with other NATO Countries. Interoperability with similarly equipped NATO country equipment is mandatory. Trailer interface shall be in accordance with NATO STANAG 4007 12 pin connector requirements.

3.10.13 Components & Vehicle Ratings. Vehicle/trailer ratings shall be manufacturer's current published ratings for on/off road operating conditions as applicable to the vehicle/trailer type. Component and vehicular ratings shall not be raised to meet the requirements of the specification. When published ratings are not available, component manufacturer's verification of rating must be submitted to the Engineering Office of the Procuring Activity. Maximum axle loads allowed by all State and NATO countries shall be complied within relation to load distribution, front to rear.

3.10.14 Specific Automotive Requirements.

3.10.14.1 Engine.

3.10.14.2 Engine Cooling System. The cooling system shall meet the requirements of SAE J1436 except for the following:

Inspection of fluid fill levels shall be accomplished without removal of caps from coolers or surge tanks. A cooling system shall be furnished capable of maintaining engine and transmission operating temperatures within the specified limits while operating continuously under full load at a 0.60 Tractive Effort to Gross Vehicle Weight ratio (TE/GVW) under the maximum conditions of 120 degrees F (49 degrees C) and the cooling system shall be capable of not exceeding temperature limits while operating at rated engine power. The radiator shall be guarded against thrown stones and damage by contact with vegetation.

3.10.14.3 Fan clutch. If a fan clutch is used, a positive lockup shall be provided in case of a clutch or a control system failure.

3.10.14.4 Permanent Oil Filtration. A permanent filtration system with a filter rating of 10 microns or less shall be installed. Cleanable filters, if used, shall have a filtering rating of at most 10 microns. A restriction indicator cab mounted light shall be used to indicate when the element needs cleaning.

3.10.14.5 Engine Speed Control. An idle RPM control is required to permit increasing and setting engine idle RPM without using a foot and/or hand throttle to support winch operations and cold weather start procedures. This high RPM control shall operate only when the vehicle is in park or neutral and automatically disengage when the vehicle is placed in gear. Tamper resistant means shall be provided to limit the maximum engine speed to the engine manufacturer’s maximum recommended

operating speed. The accelerator control system shall conform to FMVSS 571.124. *(Ref. FTTS MSV CDD 4.1.2.5.6)*

3.10.14.6 Air Cleaner. The vehicle shall incorporate an air cleaner that complies with the requirements of MIL-PRF-62048, Air cleaner, automotive, heavy duty dry type, except that the cleaner shall provide a minimum dust capacity sufficient for 60 hour service life without removal and cleaning. The induction air ducts shall not require disassembly for normal vehicle maintenance or element servicing. Air cleaner restriction indicator, visible from the driver's seat, shall be provided. The restriction indicator shall retain and display the highest restriction level attained during vehicle operation. The indicator shall be resettable from inside the cab and shall retain the reading after the engine is shut off.

3.10.14.7 Retarder. A retarder with modulated driver control shall be provided which develops at least 70% of the rated horsepower output of the engine as measured at the wheels.

3.10.14.8 Sampling Valves. Oil sampling valves (reference MIL-V-81940, part number M81940/2-1), shall be provided in a readily accessible location for the engine, transmission, and hydraulic system. The oil sampling valves shall withdraw from the oil pressure galleys ahead of the oil filters while the engine is running. The valves shall be located in such a manner as to insure that personnel shall not be exposed to danger when taking samples with the engine running. Each sampling valve location shall be labeled to easily identify the source of the sample.

3.10.14.9 Visual Filter Condition Indicators (Objective). All oil filters on the steering and hydraulic system shall include filter condition indicators to determine need for replacement visible from the driver's seat.

3.10.14.10 Exhaust System. The exhaust system shall conform to FMCSR 393.83. The exhaust system as installed shall be gas tight and leakproof to prevent the accumulation of exhaust gas in the occupied areas in accordance with best commercial practice. The exhaust pipe(s) shall be configured to prevent entry of water when vehicle is not operating. Exhaust mufflers and exhaust pipes shall be corrosion resistant and shall be furnished with adequate guards/shielding to prevent personnel contact.

3.10.14.11 Gear Train.

3.10.14.11.1 Transmission (If Applicable). The transmission shall be an automatic and shall have a gear range capable of meeting the performance specification as stated herein. The main transmission, shall include the following:

a. A downshift inhibitor system that prevents driver shift control action from overspeeding or damaging engine, transmission, or drive train components.
b. Starter Interlock. The engine starter shall be inoperative when the transmission shift lever is in a forward or reverse drive position.

c. A means to manually select and identify the gear range.
d. A neutral interlock shall be provided which shall allow the truck to start only in neutral.

3.10.14.11.2 Transfer Case (If Applicable). If utilized, the transfer case shall be installed which has the ability to provide all-wheel drive. If a single speed transfer case is used, it shall contain a planetary differential that shall provide full time all-wheel drive. A multi-speed transfer case, if used, shall provide a low range speed capability of at least 20 mph.

3.10.14.12 Steering. Power steering shall be furnished and have full limit steer when the vehicle is stationary while at GCW. In the event power assist is lost, the system shall be manually steerable and capable of being brought to a safe stop (threshold). The system at all payload conditions shall meet the requirement of the TECOM/CSTA test methodology for Dead Engine Steering Test, "Y-Course", derived from the Allied Vehicle Testing Publication (AVTP), No. 03-30WT. Throughout its entire steering arc (lock-to-lock) and including maximum tire side wall deflection, no components of the steering system shall contact or bind. All interface points within the steering system which requires lubrication shall utilize permanently lubricated joints. The steering wheel shall be capable of being locked with a standard padlock A-A-59487 (Part Identification Number AA59487-1BC).

3.10.14.13 Hydraulics System. The hydraulic system, if used, shall have provisions for operating a crane and/or other hydraulic equipment external to the vehicle and include such provisions for future use. Removable caps or plugs shall be installed at the points of attachment of the external hydraulic system to prevent dirt or other foreign objects from contaminating the system.

3.10.14.13.1 Hydraulic Reservoir. Vehicle shall have a hydraulic reservoir of sufficient capacity to operate vehicle systems and auxiliary equipment for all mission types. Reservoir shall be provided with at least the following:

a. Filter(s) shall be readily accessible for cleaning or replacement without draining the reservoir in all hydraulic circuits. Bypasses shall be furnished where necessary to protect filters during cold temperature operation.
b. Baffles to preclude foaming.
c. Dip stick, sight gage, and pressure vented type filler cap of no less than 5 psi.
d. Access size to allow manual cleaning of the reservoir.
e. Reservoir shall allow for hydraulic maintenance without draining the systems (objective).
f. Hydraulic system cooler.

3.10.14.13.2 Hydraulic Hoses & Fittings. High-pressure hoses and fittings shall conform to the requirements of SAE J516, SAE J517 and SAE J343.

3.10.14.14 Component Protection. The design shall prevent accidental damage from standing or stepping over components to gain access to

other areas of the Mission System.

3.10.15 Service & Adjustment Prior to Acceptance. Prior to government acceptance of the vehicle the contractor shall fully inspect, service and adjust each vehicle in accordance with the Vehicle Inspection Record (VIR)

4.0 VERIFICATION.

4.1 Responsibility for inspection. Unless otherwise specified in the contract, the contractor is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or this specification, the contractor may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any inspections set forth in this specification where such inspections are deemed necessary to assure supplies and service conform to prescribed requirements.

4.1.1 Responsibility for compliance. All items shall meet all requirements of Section 3. The inspections set forth in this specification shall become part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in the specification shall not relieve the contractor of the responsibility of assuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling in Quality Conformance does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to acceptance of defective material.

4.1.2 Certifications. Certification(s) of those items identified in Table I, shall be documented IAW contract requirements or instructions. Certifications do not release the contractor of 4.1.1 ("Responsibility for compliance") requirements.

4.2 Methods of Verification.

4.2.1 Test. Verification shall be accomplished through systematic operation of the end item under specified conditions, with or without instrumentation, and the collection, analysis, and evaluation of quantitative data.

4.2.2 Analysis. Verification by analysis (Table I), shall be accomplished by the application of technical or mathematical evaluation, mathematical models or simulations, algorithms, charts, or diagrams, and representative data.

4.2.3 Examination. Verification by examination shall be accomplished by visual examination (Table I) of the end item or its components, reviewing descriptive documentation, certifications, and comparing characteristics to specified criteria.

4.2.4 Demonstration. Verification by demonstration shall be accomplished by specified functional checks and/or operation of the end item or its components (Table I).

4.2.5 Certification. Verification by Certification is documented conformance to a specific requirement or standard signed by the certifying official or responsible party. When required by contract or this specification, Table I, certifications may be used in lieu of specified verification methods and must include supporting documentation (test data, material analysis, etc.). Acceptance of certifications not identified in Table I, is contingent upon government approval.

4.3 Classes of verification.

4.3.1 First Article Test. When required by contract, the First Article Test (FAT) is conducted and consists of the First Production Vehicle Inspection (FPVI) and Production Verification Test (PVT) specified in Table I.

4.3.2 First Production Vehicle Inspection. A First Production Vehicle Inspection (FPVI) is a contractor performed and government witnessed inspection of the first vehicle produced under contract (Table I), usually at the place of manufacture, utilizing one or more of the verification methods specified in Table I.

4.3.3 Production Verification Test. A Production Verification Test (PVT) of the first production end item conducted by the government and performed at a Government test site, to establish product conformance to contract, specification requirements and production capability (Table I).

4.3.4 Follow-on Production Test. Follow-on Production Test (FPT) of production end item similar is conducted as specified in Table I, to assess continued conformance to specification and contract requirements, and production capability.

4.3.5 Quality Conformance Inspection. A Quality Conformance Inspection (QCI) of the end item(s) are performed prior to government acceptance of a production vehicle, utilizing the Vehicle Inspection Record (VIR). The Vehicle Inspection Record is a record which documents all contractor verification actions and results performed on each production vehicle, including in process, and all corrective actions.

4.3.6 Control Test. When required by contract, Control Tests (CT) for maintaining and evaluating process controls, shall be conducted by the contractor as referenced in Table I. This test is performed on government selected vehicles after completion of Quality Conformance Inspection.

4.4 Verification Matrix. TABLE I displays the verification methods and classifications (events) for each applicable section 3 requirement. All verifications referenced in TABLE I may be modified at the discretion of the government by deletion or addition of items listed to assure conformance to specification and/or contractual requirements.

TABLE I - VERIFICATION MATRIX

VERIFICATION LOCATION:

First Production Vehicle Inspection (FPVI)	Manufacturer's Facility
Production Verification Test (PVT)	Government Test Site
Follow-on Production Test (FPT)	Government Test Site
Quality Conformance Inspection (QCI)	Manufacturer's Facility
Control Test (CNT)	Manufacturer's Facility

		Verification Method					VERIFICATION CLASS/EVENT			
Section 3	**Paragraph Title**	**CERT**	**ANLS**	**DEMO**	**EXAM**	**TEST**	**PVT**	**FPVI**	**FPT**	**OCI**
3.1	MISSION PROFILE									
3.1.1	Weight Definitions									
3.1.1.1	Curb Weight (CW)									
3.1.1.2	Gross Vehicle Weight (GVW)									
3.1.1.3	Gross Combined Weight (GCW)									
3.1.2	Payload									
3.1.3	Dimensions									
3.1.3.1	Width									
3.1.3.2	Height									
3.1.3.3	Length									
3.1.4	Environment									
3.1.4.1	Operating Temperatures									
3.1.4.2	Storage Temperatures									
3.1.4.3	Heater and defroster									
3.1.4.4	Cab cooling									
3.2	PERFORMANCE CHARACTERSITICS									
3.2.1	Mobility									
3.2.1.1	Dash Speed									
3.2.1.2	Governed speed									
3.2.1.3	Lateral stability									
3.2.1.4	Approach & departure angles									
3.2.1.5	Braking									
3.2.1.5.1	Service brakes									
3.2.1.5.2	Parking brakes									
3.2.1.5.3	Emergency brakes									
3.2.1.5.4	Brake configuration									
3.2.1.5.5	Antilock Braking System (ABS)									
3.2.1.5.6	Brake wear indicator									
3.2.1.6	Terrain									
3.2.1.7	Ride quality									
3.2.1.7.1	Ride Limiting Speeds									
3.2.1.7.2	Vertical Acceleration									
3.2.1.8	Reserved									
3.2.1.9	Reserved									
3.2.1.10	Grade and Slope Operations									
3.2.1.10.1	60% Grade									
3.2.1.10.2	Parking Brake Grade Operation									
3.2.1.10.3	40% Side Slopes									
3.2.1.10.4	5% Grade									
3.2.1.11	Tires									
3.2.1.11.1	Rims and tires									
3.2.1.11.2	Run-flat capability									

3.2.1.11.3	Limp home capability									
3.2.1.11.4	Central tire inflation system (CTIS)									
3.2.1.11.4.1	Tire pressure control									
3.2.1.11.4.2	Manual tire inflation/deflation									
3.2.1.11.4.3	Air-priority system									
3.2.1.11.4.4	Speed/pressure control warning									
3.2.1.11.4.5	Maintenance of tire pressure									
3.2.1.11.4.6	Time to inflation/deflation									
3.2.1.12	Traction Control									
3.2.1.13	Turning requirement									
3.2.1.14	Lane changing									
3.2.1.15	Power Take-Off (PTO) openings									
3.2.1.16	Steerable/lockable rear axle									
3.2.1.17	Emissions									
3.2.1.18	Power Generation									
3.2.1.18.1	DC Power Source									
3.2.1.18.2	AC Power Source									
3.2.1.18.3	Slave Receptacle									
3.2.1.18.4	Depleted Battery Engine Start									
3.2.1.18.5	Extended Electrical Capability/Capacity									
3.2.1.18.6	Energy Storage									
3.2.1.19	Silent Watch Capability									
3.2.2	Operational Range									
3.2.2.1	Range									
3.2.3	Standard Obstacles									
3.2.3.1	Vertical step									
3.2.3.2	Trench Crossing									
3.2.3.3	Fording									
3.2.4	Towing									
3.2.4.1	Like Vehicle Towing									
3.2.4.2	Reserved									
3.2.4.3	Recovery/Towing									
3.2.4.4	Towed Load Capability									
3.2.4.4.1	Companion Trailer									
3.2.4.4.2	Backward Capability									
3.2.4.5	Towed Load Power and Control									
3.2.4.6	Reserved									
3.2.4.7	Tow Eyes									
3.2.4.8	Backing									
3.2.4.9	Pintle									
3.2.4.9.1	Second Pintle									
3.3	SURVIVABILITY									
3.4	TRANSPORTABILITY									
3.4.1	Weight Limitations									
3.4.2	Size Limitation									
3.4.3	Lifting & Tie-Down Provisions									
3.4.3.1	Lifting Eyes									
3.4.4	C-130 Air Transport									
3.4.4.1	C-130 Ramp									
3.4.4.2	Preparation Time									
3.4.5	C-5 Air Transport									
3.4.6	C-17 Air Transport									
3.4.7	Commercial Transport									
3.4.8	Highway Transport									
3.4.9	Rail Transport									
3.4.10	Water Transport									
3.4.11	Hazardous material transport									
3.5	VEHICLE COMMAND, CONTROL, COMMUNICATIONS, COMPUTERS AND INTELLIGENCE (C4I)									
3.5.1	Reserved									
3.5.1.1	Common Information Systems									
3.5.1.2	Reserved									
3.5.1.3	Common Relevant Operating Picture (CROP)									
3.5.1.4	Embedded Readiness System									

3.5.1.5	Sustainment Data and Reporting									
3.5.1.6	External Interfaces									
3.5.1.7	Objective Performance (OP) C4I Hardware Package									
3.5.2	Minimum Demonstrator C4I Functionality									
3.5.2.1	Force XXI Battle Command Brigade and Below (FBCB2)									
3.5.2.2	Movement Tracking System (MTS)									
3.5.2.3	En Route Mission Planning & Rehearsal System									
3.5.3	Electrical system									
3.5.3.1	System Grounding									
3.5.3.2	Electrical Accessories									
3.5.3.2.1	Meals Ready to Eat (MRE) Outlet									
3.5.3.2.2	110 V AC Electrical Power Location									
3.5.3.2.3	Power & Data Growth Capability									
3.5.4	Vehicle Management Software									
3.5.4.1	Vehicle Operational Management									
3.5.4.1.1	Failure Detection and Recovery									
3.5.4.1.2	Initialization									
3.5.4.1.3	C4ISR Computer Startup									
3.5.4.1.4	Software-Enabled Vehicle Control									
3.5.4.1.5	Automation and Semiautomation Support									
3.5.4.1.6	Sensor Control Support									
3.5.4.1.7	Vehicle Safety Management									
3.5.4.1.8	Status Acquisition and Control									
3.5.4.1.9	Reporting									
3.5.5	Lighting									
3.5.5.1	Headlights									
3.5.5.2	Exterior Work lamps									
3.5.5.3	Convoy warning lights									
3.5.5.4	Secure lighting									
3.5.6	Wiring									
3.5.7	Reserved									
3.5.8	Electrical Conectors									
3.5.9	Crew Indicators									
3.5.9.1	Master Power Cutoff Switch									
3.5.10	Databus Connectors									
3.5.11	Data Storage									
3.5.12	Interrogation Capabilities									
3.5.13	Vehicle Backup Alarm									
3.5.14	Identifying Friend or Foe (IFF) devices									
3.5.15	Driver's Vision Enhancements									
3.5.15.1	Night Vision Enhancer									
3.6	RELIABILITY, MAINTAINABILITY, & DURABILITY (RM&D)									
3.6.1	Reliability									
3.6.1.1	Mean Time Between System Aborts									
3.6.1.2	Mean Time Between System Aborts–Mobility									
3.6.1.3	Mean Time Between Essential Function Failures									
3.6.2	Maintainability									
3.6.2.1	Automation									
3.6.2.2	Design for Maintainer									
3.6.2.2.1	Component Accesibilty and Identification									
3.6.2.3	Maintenance Ratio–Maintenance Man-Hours per Operating-Hour									
3.6.2.4	Time to Repair									
3.6.2.5	Preventive Maintenance Checks and Services									
3.6.2.5.1	Preventive Maintenance Checks (PMC)									
3.6.2.5.2	Scheduled Services									
3.6.2.6	Doors and Maintenance Access									
3.6.2.7	Subsystem/Component Serviceability									
3.6.2.8	Electrical Connectors									
3.6.2.9	Filters									
3.6.2.10	Prognostics and Diagnostics									
3.6.2.10.1	Prognostics									
3.6.2.10.2	Diagnostics									
3.6.2.10.3	Vehicle-to-Vehicle Umbilical Diagnostics									
3.6.2.10.4	Common Tools									
3.6.2.10.5	Reserved									
3.6.2.10.6	Interactive Electronic Technical Manuals (IETM)									
3.6.2.10.7	I.E.T.M Embedded Video Maintenance Support									
3.6.3	Durability									
3.6.3.1	Drive Train Components									
3.6.3.2	Wearout									
3.6.4	Availability									
3.6.4.1	Operational Availability (Ao)									
3.6.4.2	Service Life									

3.7	MANPOWER & PERSONNEL INTEGRATION (MANPRINT)									
3.7.1	Human Factor Engineering									
3.7.2	Crew Compartment									
3.7.2.1	Cab									
3.7.2.2	Crush Protection									
3.7.2.3	Seating									
3.7.2.4	Crew Restraint System									
3.7.2.5	Windshield and windows									
3.7.2.6	Windshield wipers and washers									
3.7.2.7	Vehicle cab interior									
3.7.2.8	Cab floor drains									
3.7.2.9	Chemical protective equipment storage									
3.7.2.10	M4/M16 rifle mounting									
3.7.2.11	Cab temperature control									
3.7.2.12	Rear view mirrors									
3.7.2.13	Stowage									
3.7.2.14	Displays									
3.7.2.14.1	Display Visibility and Audibility									
3.7.2.14.2	Visual Display Performance									
3.7.2.14.3	Controls									
3.7.2.15	Control Design and Mechanization									
3.7.2.16	Control/Display Integration									
3.7.2.17	Position Relationships									
3.7.2.18	Movement Relationships									
3.8	MATERIAL HANDLING EQUIPMENT (MHE)									
3.8.1	Intelligent Load Handling Systems (ILHS).									
3.8.1.1	Vehicle Integration									
3.8.1.2	Weight									
3.8.1.3	Operation									
3.8.2	ILHS Systems Components									
3.8.2.1	Manipulator									
3.8.2.1.1	Cartesian Control									
3.8.2.1.2	Teleoperation									
3.8.2.1.3	Semi-Autonomous Transport Path									
3.8.2.1.4	Kinematic Configuration									
3.8.2.1.5	Payload Capacity									
3.8.2.1.6	Reserved									
3.8.2.1.7	Velocity									
3.8.2.1.8	Minimum step size									
3.8.2.1.9	Repeatability									
3.8.2.1.10	Overshoot									
3.8.2.1.11	Position Feedback									
3.8.2.1.12	Stowage									
3.8.2.1.13	Safety									
3.8.2.1.14	End-effector									
3.8.2.2	Platform Handling System									
3.8.2.2.1	Payload									
3.8.2.2.2	Operation									
3.8.2.2.2.1	Reserved									
3.8.2.2.2.2	Self Load/Off Load									
3.8.2.2.2.3	Load Conditions									
3.8.2.2.2.3.1	Vertical Condition									
3.8.2.2.2.3.2	Lateral and Longitudinal Condition									
3.8.2.2.2.3.3	Approach Angle									
3.8.2.2.3	Overload									
3.8.2.2.4	International Standards Organization (ISO) Locks									
3.8.2.2.5	Modular Interface Platform (MIP) Interface									
3.8.2.2.6	Redundancy and Manual Backup									
3.8.2.2.7	Vehicle Alignment System									
3.8.3	Stabilization System									
3.8.3.1	Ground Inclination Limits									
3.8.3.2	Manipulator Inhibit & Backup									
3.8.4	Electrical System									
3.8.5	Hydraulic System									
3.8.6	Operator Interface									
3.8.6.1	Operator Control Station									
3.8.6.2	Operator Control Pendant									

3.9	FTTS MSV COMPANION TRAILER (CT)									
3.9.1	General									
3.9.1.1	Commonality									
3.9.2	Mission Profile									
3.9.3	Trailer Payload									
3.9.4	Dimensions									
3.9.4.1	Height									
3.9.5	Performance Characteristics									
3.9.5.1	Mobility									
3.9.5.1.1	Tracking									
3.9.5.1.2	Autonomous Operation (Objective)									
3.9.5.1.2.1	Range									
3.9.5.1.3	Braking									
3.9.5.1.3.1	Separated Brake System									
3.9.5.1.3.2	Military & FMVSS Compliance									
3.9.5.1.4	Coupling/Uncoupling									
3.9.5.1.5	Tires/Wheels									
3.9.5.2	Standard Obstacles									
3.9.5.3	Expediency/Emergency Towing									
3.9.5.3.1	Backing Truck-Trailer Combination									
3.9.5.4	Trailer Transloading Capability									
3.9.5.5	FCS Interface									
3.9.6	Reserved									
3.9.7	Reserved									
3.9.8	Deployability and Transportability									
3.9.8.1	Roll-On/Roll-Off Capability (Objective)									
3.9.9	Trailer Command, Control, Communications, Computers and Intelligence (C4I)									
3.9.9.1	Sustainment Data and Reporting									
3.9.9.2	Diagnostic/Prognostics									
3.9.9.2.1	Payload Data									
3.9.9.2.2	Anti-Rollover System									
3.9.9.3	Identifying Friend or Foe (IFF) Devices									
3.9.9.4	Unique Identification (UID)									
3.9.10	Power Generation									
3.9.11	Reliability, Maintainability & Durability (RM&D)									
3.9.12	Manpower & Personnel Integration (MANPRINT)									
3.9.13	Ride Quality									
3.10	GENERAL									
3.10.1	Fuels and Lubricants									
3.10.1.1	Fuels and lubricants									
3.10.1.2	Vehicle lubrication									
3.10.1.3	Self refueling									
3.10.1.4	Fuel Access Connection									
3.10.2	Materials, Painting, and corrosion									
3.10.2.1	Material									
3.10.2.2	Camouflage									
3.10.2.3	Corrosion Resistance									
3.10.3	Potable Water									
3.10.3.1	Water Generation									
3.10.3.2	Water Dispenser									
3.10.3.3	Water Cross-Leveling									
3.10.3.4	Captured Water from Environmental Control System									
3.10.4	Commerciality/commonality, components, parts, and accessories									
3.10.5	Vehicle security									
3.10.6	Controls and Control Cables									
3.10.7	Rear Reflective Signature									
3.10.8	Collision Warning System									
3.10.9	Kits									
3.10.9.1	Engine Arctic Kit									
3.10.10	Workmanship									
3.10.11	Servicing and Adjusting									
3.10.12	Interoperability, Standardization and Compatibility with other NATO Countries									
3.10.13	Components and Vehicle Ratings									
3.10.14	Specific Automotive Requirements									
3.10.14.1	Engine									
3.10.14.2	Engine Cooling System									
3.10.14.3	Fan Clutch									
3.10.14.4	Permanent Oil Filtration									
3.10.14.5	Engine Speed Control									
3.10.14.6	Air Cleaner									
3.10.14.7	Retarder									
3.10.14.8	Sampling Valves									
3.10.14.9	Visual Filter Condition Indicators (objective).									
3.10.14.10	Exhaust System									
3.10.14.11	Gear Train									
3.10.14.11.1	Transmission (If applicable).									
3.10.14.11.2	Transfer case (If applicable).									
3.10.14.12	Steering									
3.10.14.13	Hydraulics System									
3.10.14.13.1	Hydraulic Reservoir									
3.10.14.13.2	Hydraulic Hoses and Fittings									
3.10.14.14	Component protection									
3.10.15	Service and Adjustment Prior to Acceptance									

ANNEX

A.1 Distribution Variant

B. Fuel Variant

C. Water Variant

D. Wrecker Variant

General. The FTTS wrecker is the recovery and maintenance system envisioned for employment within both the Unit of Action and Unit of Employment. Requirements common to all FTTS are discussed in the main portion of this ORD.

Field Level maintenance will consist of repair-and-return-to-user on system-tasks, those tasks that do not require disassembly of a component (Primarily LRU/LRM replacement), and will be performed forward in the battle space, as the supported units battle rhythm permits. Sustainment maintenance will consist of repair-and-return-to-supply off-system tasks, required to return components, subassemblies, and/or end item systems to a serviceable condition. Each UA will have a small number of 2-3 men Combat Repair Teams (CRT)within their organic Forward Support Battalion (FSB) to perform field maintenance requirements beyond the capabilities of the crew chief/crew, More in-depth BDAR, and limited recovery operations equipped with FTTS wrecker. Platforms and systems deemed unsuitable for repair on site will be recovered toa safer location for those repairs necessary to allow the platform to return to action and complete its current mission. Primary method of recovery will be self or like vehicle recovery, augmented by the CRT/FTTS wrecker/FRMV capabilities when required.

D.4.1 FTTS-MRV (Maintenance Recovery Variant) will possess the following characteristics in addition to the basic vehicle requirements

D.4.2 The FTTS wrecker must be capable of recovering and righting all FTTS and FCS ground platforms under all conditions (climatic and terrain) in which the UE will operate, from the point of failure to the mission stating site.

D.4.3 The wrecker variant shall be able to lift and tow and flat tow all UA systems and current TWV at GCW front or rear without damage to either the towed or towing vehicles through the full range of the towing vehicle’s performance characteristics without restriction,

D.4.4 Wrecker variant shall provide the ability to umbilical the brake system for towed loads.

D.4.5 The wrecker shall be designed to perform its functions with a crew of two

D.4.6 Tool storage capacity shall be sufficient to provide secure storage for all required collateral and on-vehicle equipment (OVE) as well as general mechanics tool kits, BDAR kits, and selected critical combat spares. All stowage shall be rainproof and equipped with drain holes. Equipment subject to damage from water that would make it inoperable shall be stored in rainproof stowage above the fording line to avoid requiring waterproofing storage compartments. Access to storage will be unhindered. Tool storage areas shall be designed to prohibit damage to all contents.

D.4.7 A capability to employ power tools to speed recovery / repair operations shall be incorporated in the wrecker variant.

D.4.8 The wrecker shall incorporate the capability to cut both ferrous and non-ferrous metals.

D.4.9 The winch or winches shall be of sufficient capacity to perform up to a double line recovery of 150% of the HGVW of the recovered vehicle.

D.4.10 The wrecker variant shall incorporate the ability to remove, traverse, and place the heaviest powerpack from all platforms within the UA

D.4.11 The wrecker must possess a capability to power the hydraulic lift system on the FTTS MSV cargo variant.

D.4.12 Interactive Electronic Technical Manuals (IETM). Each FTTS MRV must have an on-board, full IETM for all systems in the UA/UE that includes operator and maintainer technical manuals (TMs) and Repair Parts and Special Tool Lists (RPSTL) for all onboard equipment, including GFE items (Threshold/Objective). The embedded virtual full task trainer will be fielded concurrently with the FTTS. All technical manuals must be Class 5 or higher, Interactive Electronic Technical Manuals, and include an embedded training to assist the mechanic/operator in performing maintenance tasks and diagnosis.

E. Tactical Unmanned Aerial Vehicle (TUAV) Carrier Variant

ANNEX

F.1 Non Line of Sight Launch System (NLOS LS) Variant